

NASA TOTAL QUALITY MANAGEMENT

1989 ACCOMPLISHMENTS REPORT

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NASA QUALITY AND PRODUCTIVITY IMPROVEMENT PROGRAMS

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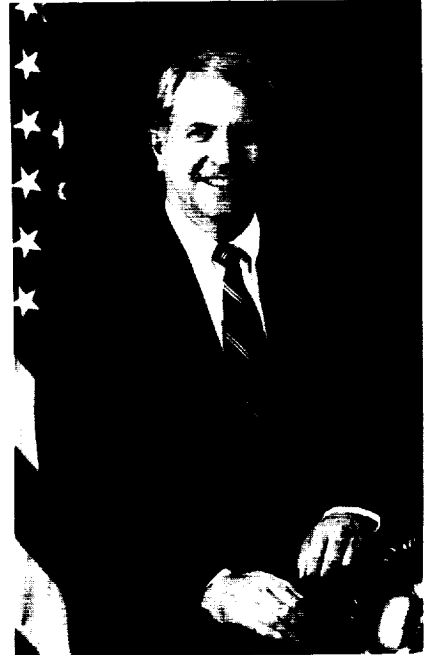


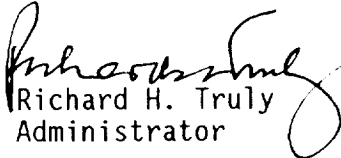
## FOREWORD

People are more aware than ever of the increasing competition from abroad. The market competition we face today will shape the way we do business for decades to come. NASA and its contractor community have met this year's challenges with many new ways to achieve success with quality improvements in products, services, processes, and work environments. This Accomplishments Report reflects some of the many continuous improvement efforts.

The efficiency with which our team has accomplished these quality improvements signifies that we are ready to push onward. We can look forward to future success in NASA's continued exploration into space and the scientific realm. NASA credits the innovative, team-spirited, quality conscious individuals and groups who cooperatively brought the vision of mission success to reality. Every improvement effort contributed to that success.

I thank you for your improvement efforts and look enthusiastically to a successful 1990; a year in which we are certain to reap additional benefits from the strong foundation of commitment to Total Quality Management (TQM).



  
Richard H. Truly  
Administrator



## PREFACE

NASA and contractor employees achieved many notable improvements in 1989. The highlights of those improvements, described in this seventh annual Accomplishments Report, demonstrate that the people who support NASA's activities are getting more involved in quality and continuous improvement efforts. Their gains solidly support NASA's and this Nation's goal to remain a leader in space exploration and in world-wide market competition, and, when communicated to others through avenues such as this report, foster improvement efforts across government and industry.



The principles in practice which led to these process refinements are important cultural elements to any organization's productivity and quality efforts. The categories in this report reflect NASA principles set forth in the 1980s and are more commonly known today as Total Quality Management (TQM).

- Top Management Leadership and Support
- Strategic Planning
- Focus on Customer
- Employee Training and Recognition
- Employee Empowerment and Teamwork
- Measurement and Analysis
- Quality Assurance

Because we were unable to publish all the accomplishments, the exemplary attainments published herein only represent some instances of increased efficiency and savings in time and money. All efforts are important because each triumph increases our performance standards and enables us to reach our objective of excellence.

You are encouraged to use this information, including the contact name and phone number, so that our continuous improvement efforts proliferate and contribute to our mutual future success.

A handwritten signature in cursive script, appearing to read "G. A. Rodney".

George A. Rodney  
Associate Administrator for  
Safety and Mission Quality





# NASA TQM INITIATIVES

## I. TOP MANAGEMENT LEADERSHIP AND SUPPORT

### 1. JOINT US/USSR COSMOS PROJECT EXPANDED

*Ames Research Center (ARC)*

#### Description of the Activity:

In order to maximize the science return per dollar and man-hour expended, the Space Life Sciences Payloads Office has expanded the Joint US/USSR Cosmos Project through careful planning and negotiations with NASA Headquarters and Soviet mission management.

The safety and quality assurance regulations governing the development and flight of experiments on U.S. manned spaceflights necessitate large dollar and manpower expenditures. Flight on the unmanned Soviet Cosmos biosatellites offers frequent flight opportunities with far less rigorous SR&QA, and the Soviets do not charge the U.S. any launch costs.

Recognizing the cost effectiveness of flying on the Soviet spacecraft, areas of high science interest were identified with Program Managers at NASA Headquarters, and a NASA Research Announcement was prepared and released. Experiments were selected which had high scientific merit, high program relevance, and which could be developed with minimal resources. The Space Life Sciences Payloads Office developed a matrix arrangement with the Life Science Division to obtain science support which kept support service contract manpower costs to a minimum.

Vigorous negotiations with Soviet mission management resulted in Soviet acceptance of more than 90 percent of U.S. proposed experiments.

#### Benefits Achieved:

More than 80 U.S. scientists participated in the 14-day flight of Cosmos 2044 in September 1989, and returned with tremendous amounts of data at only a fraction of the cost of flying similar experiments on the U.S. Space Shuttle.

While not all experiments can be conducted on unmanned spacecraft, the opportunity to fly Life Science experiments on the Cosmos spacecraft has enabled U.S. scientists to gain valuable spaceflight experience and data, and refine hypotheses and theories to better utilize the capabilities and advantages of our manned spacecraft.

Contact for more information:

Kenneth Souza  
415-604-5736

## 2. RECRUITING CAREER DAY

### *Goddard Space Flight Center (GSFC)*

#### Description of the Activity:

In Spring 1989, GSFC introduced a recruiting career day equivalent to private sector "plant visits" for graduating scientists and engineers. Forty-five graduating students were invited to GSFC to tour the center and be interviewed by selecting officials. Twenty-eight students received job offers and 75 percent of these offers were accepted. The Office of Personnel Management published an article on this activity in their Fall 1989 Federal Staffing Digest.

#### Benefits Achieved:

Forty-five outstanding candidates were interviewed in one day. Selections and offers were immediately made. Senior management support was outstanding (as many managers as students attended the reception on Sunday evening). Managers became more aware of the candidates in the center's Applicant Supply File, and 21 candidates have joined the GSFC work force.

Contact for more information:

William Ingerski  
301-286-8202

## 3. TEAM EXCELLENCE - PURSUING INITIATIVES ON THREE FRONTS

### *Johnson Space Center (JSC)*

#### Description of the Activity:

During 1989, the Team Excellence program continued to focus on initiatives in four major areas: continuous improvement projects, strategic planning implementation, the culture survey process, and contractor partnerships. Program effectiveness was reviewed by OMB, and the center was accorded recognition as a 1990 OMB Quality Improvement Prototype.

Continuous Improvement Projects -- Initiatives continued to focus on improving work processes through structured problem solving and employee involvement. A major effort was initiated in cooperation with the New Initiatives Office to define an effective process for centerwide technology management involving several team projects (see JSC/Strategic Planning category for more information). In addition, there were organizational improvement efforts in a number of other areas. For example:

- In the Orbiter Project Office actions were identified to improve communications and clarify various roles and responsibilities.

- In the Safety, Quality and Reliability Office, an effort was initiated to improve business practices and develop a software quality assurance process.

Strategic Planning & Implementation -- A major thrust was implementation of the strategic plan. Eighteen critical issues were identified in four major areas: NSTS, Technology, Space Station, Organization and Human Resources. Management teams were organized to address those issues.

Culture Survey -- The center administered its second culture survey to obtain data on employee perceptions of what is important in the organization and the way that work is accomplished. The survey provided center management with an updated understanding of perceived strengths and weaknesses in the center's work environment. It also provided a measure of the changes that had taken place in employee perceptions since the first survey in 1986. In addition, the center added a number of questions unique to JSC to obtain data previously not collected. Employee focus groups across the center were formed to provide additional input regarding survey results, and a top management team is developing action plans to address key issues (see JSC/Measurement and Analysis-Culture Survey accomplishment for more information).

Contractor Partnership -- The center continued to vigorously support a partnership relationship with its contractors. This was accomplished primarily through the JSC/Contractor Team Excellence Forum, an organization comprising JSC and contractor representatives to provide a mechanism for exchanging information and ideas across the JSC team. The Forum established a new working group to support the JSC strategic planning effort. This new team assisted the center in planning the second JSC/Contractor Strategic Planning Workshop held in January. More than 200 civil service, contractor, academic, and economic development leaders attended this event. The meeting provided an update of the center's strategic planning activities, reviewed JSC contractor strategic planning group initiatives, and addressed next steps in the long-term planning process. The outstanding support provided by JSC contractors to the center's quality improvement effort was recognized during the 1989-90 NASA Excellence Award cycle. Not only did a JSC contractor receive the award (Lockheed Engineering and Sciences Company), three others were recognized as award finalists (Barrios Technology, Inc., Computer Sciences Corporation, and Rockwell).

The most significant resource devoted to the JSC Team Excellence initiatives has been the time committed by managers and employees at all levels. However, center management also made a major commitment to these efforts during FY89 by providing four staff years of organizational development support to Team Excellence activities.

#### Benefits Achieved:

Through the Strategic Planning implementation process, we have sharpened our vision about the future and identified key leverage areas for change. This effort is positioning the center to support President Bush's Lunar/Mars Space Initiatives.

We have found that involving managers and employees in planning activities provides momentum to the change process. Thus, individuals from all organizational levels become "agents" for change -- they see the challenges which lie before us, and understand why we need to improve the way we do business.

Approximately 500 civil service individuals have worked together in numerous team excellence projects designed to improve various internal processes and systems. In addition, we are opening up channels of communication with the contractor community to work together in areas which serve our mutual interests.

Finally, the Culture Survey process has proven to be an important tool for systematically listening to our people and understanding the strengths and weaknesses of our work environment. The process demonstrates to the employees that we care, and helps develop a work environment which is more supportive toward achieving the high-caliber work for which we are striving. The naming of JSC as a Federal Quality Improvement Prototype for 1990 by the Office of Management and Budget, is testimony to the joint efforts of the entire JSC community whose contributions are building both a better product and team spirit.

Contact for more information:

Leslie J. Sullivan  
713-483-4723



*JSC's Team Excellence logo embodies the spirit of the program.*

#### 4. LaRC HOSTS NASA EMPLOYEE TEAM COORDINATORS

##### *Langley Research Center (LaRC)*

##### Description of the Activity:

A meeting of the NASA Employee Team coordinators from all NASA Field Centers and Headquarters was held in Williamsburg, VA, November 6-9, 1989. John Stokes, Director of Management Operations, welcomed the attendees. Joyce Jarrett, Director, NASA Quality and Productivity Improvement Programs, also addressed the group.

##### Benefits Achieved:

This meeting served as an excellent information exchange on center efforts and future plans. NASA Contractor representatives also attended. Several new center coordinators had the opportunity to meet their counterparts from other centers.

Contact for more information:

Clarence M. Cole  
804-864-3292



*The NASA Employee Team Coordinators meet at Langley to discuss future team endeavors: (from left to right): Don Carr, Martin Marietta Manned Space Systems; William Williams, LaRC; Margaret Lennard, Pan Am World Services; Skip Cole, LaRC; Peggy Wilson, KSC; Mary Wong, JPL; Robert Marton, Bendix; Mary Kovach, LeRC; Carolyn McMillan, MSFC; Dale Crossman, NASA HQ; Merideth Moore, ARC; Ralph Tortorich, MMMSS; Diane Greenfield, Pan Am World Services; and Gene Elleman, Cortez III. Not pictured: Grace Martinez, JSC; Karen Whitney, Rockwell Shuttle Operations Co.; John Lyons, NASA HQ; Joyce Jarrett, NASA HQ; Stacy Day, GSFC; and Monte Krauze, Bendix.*

## 5. LEWIS MANAGEMENT SPONSORS TQM WORKSHOPS

*Lewis Research Center (LeRC)*

### Description of the Activity:

As a result of winning the 1989 Quality Improvement Prototype (QIP) Award, Lewis management worked with the Office of Management and Budget to hold workshops on quality and productivity improvement for other federal organizations.

About 400 federal employees attended two sessions, one in Washington, D.C., and the other at the center, to hear about Lewis' programs. Attendees included directors, managers, and working-level employees from a wide range of federal agencies. Topics covered included strategic planning, employee involvement, training and development, rewards and recognition, labor-management relations, cross-functional teams, and case studies of the Materials Division and Procurement Division.

During the same period, center management held a retreat to learn more about initiatives in the private sector. IBM's Systems Integration Division and the 3M Corporation discussed their efforts in TQM, and answered questions from center management. A highlight videotape of the retreat was made available to supervisors and employees.

### Benefits Achieved:

After winning the QIP Award, top management was concerned that the center not rest on its laurels or reduce the pace and commitment to TQM. By teaching others about Lewis' TQM program, center management reinforced their own commitment to continuous quality and productivity improvement and learned how other organizations used TQM to improve. In-depth discussions with IBM and 3M demonstrated the critical need for continual improvement in response to today's rapidly changing and competitive environment, and increased top management understanding of what could be achieved through TQM.

Contact for more information:

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216-433-2914

## 6. TOTAL QUALITY MANAGEMENT (TQM) ACTIVITIES

*Marshall Space Flight Center (MSFC)*

### Description of the Activity:

In his first address to the employees of MSFC after his appointment as Center Director, Mr. T. J. Lee vigorously endorsed a program of continuous improvement through TQM. Since then, top managers of the center have attended presentations and seminars designed to better acquaint them with the TQM philosophy and to give them the background necessary to implement an appropriate program at MSFC.

In March, Colonel Wormington gave the MSFC Productivity Steering Council (MPSC) an overview of the TQM program for the Advanced Launch Systems (ALS) Project. This was followed in July by a more detailed presentation of the same program to the MSFC Center Council by Dr. Toru Iura. At the August Center Council Meeting (CCM), Dr. Deming's book "Out of the Crisis" was reviewed by members of the MPSC. Also in August, a number of center managers attended a presentation by Dr. Deming at the University of Alabama in Huntsville. October was an especially busy month with four center managers attending a Deming Seminar sponsored by Ford Aerospace, 30 managers attending an ALS senior management TQM seminar at MSFC's training facility, and three managers attending a Deming Seminar sponsored by George Washington University. In November, four managers attended an expanded ALS seminar in California; and, in December, Mr. Philip Crosby presented his views to the MPSC.

#### Benefits Achieved:

The presentations and seminars attended by MSFC top management has given them insight into the TQM philosophy and will enable them to establish a viable and appropriate Total Quality Management Program at MSFC.

Contact for more information:

Joseph A. Bethay  
205/544-1919

## 7. CENTER-WIDE IMPLEMENTATION OF TQM BY STEERING COMMITTEE

### *Stennis Space Center (SSC)*

#### Description of the Activity:

NASA/SSC initiated a steering committee consisting of top management of the three prime contractors and NASA, which comprise the majority of personnel located at SSC in support of SSME testing. The steering committee initiated planning and discussion on the center-wide implementation of TQM. First, a briefing was held for all NASA and contractor management on basic TQM concepts and the benefits that result from the sound implementation of the TQM process. Secondly, an assessment instrument based on the draft circular to replace A-132 was developed and is being used to ascertain the present status of each organization relative to implementing the TQM process. This data will serve to add detail to the strategic plan and will structure the implementation of the process during the next decade.

#### Benefits Achieved:

The TQM Steering Committee is evaluating training materials and options to develop a training and development plan. A one-day management seminar has been developed by Pan Am World Services at Stennis and will serve as the first step in orienting the entire civil servant and contractor work force to the TQM process.

Four system analysis teams that include World Services and NASA managers are operating at SSC. These teams, in logistics, food services, visitors center, and transportation, study the present system, evaluate where non-value added activities or rework are concentrated, improve the system and measure their results. Since their inception, several improvements in each system have been obtained, and their impact on quality and productivity enhancement is being evaluated by these integrated management teams.

Contact for more information:

Marco Giardino  
601-688-2739

## 8. RE-ORGANIZATION OF THE HEADQUARTERS RESOURCES ORGANIZATION

### *NASA Headquarters (Code M)*

#### Description of the Activity:

The Office of Space Flight reorganized to combine the Space Shuttle and Space Station program activities. The Resources Management Office was established in this reorganization to perform resources control for all the Office of Space Flight.

Under the Resources Management Office, a Program Evaluation Branch was formed to perform duties such as assessment of integrated program requirements, establishment of new content evaluation criteria, analysis of new start requests, and assistance in policy formulation.

The Resources Management Office also identified and established concrete roles and responsibilities across the Level I and Level II Resources organizations to eliminate workload redundancies and inefficiencies.

#### Benefits Achieved:

The Resources Management Office's establishment of the Program Evaluation Branch serves to strengthen Headquarters' ability to provide integrated assessment and analysis across programmatic and project boundaries. The definition of roles and responsibilities eliminated redundancies and enhanced productivity to the extent that the authorized ceiling of the Resources Management Office was reduced from 118 to 101.

Contact for more information:

David Bates  
202-453-2102



9. SIXTH ANNUAL NASA/CONTRACTORS CONFERENCE DRAWS MORE THAN 800 REPRESENTATIVES FROM GOVERNMENT, INDUSTRY, AND ACADEMIA

*NASA Headquarters (Code Q)*

Description of the Activity:

The annual NASA/Contractors Conference, conducted by the NASA Quality and Productivity Improvement Programs Office, serves as a forum for information exchange on the most current government, industry, and national quality and productivity issues.

The sixth annual event, hosted by Marshall Space Flight Center, provided more than 800 attendees with 30 panel and keynote presentations on a wide range of topics. More than 80 speakers from government, industry, and academics spoke on commitment to quality in manufacturing and service, the future role of education in strengthening this nation's competitive position, employee training, technology management, NASA/contractor partnerships, quality and productivity measurement, and quality and productivity in organizational culture.

NASA Deputy Administrator J.R. Thompson, Jr., in his opening address, expressed the common goal of all who attended. He said that we need not invent or implement anything new in order to compete in the international market place, but that we need to "clearly focus on the necessity to continually improve our performance."

The attendance record set this year clearly shows that NASA and its partners are committed to excellence and are ready to take action to improve their performance in whatever they do.

Benefits Achieved:

This ongoing program provides a channel for NASA/contractor communication; for experienced leaders to share ideas and lessons learned. Experiences of these participants carry much value when communicated to other organizations seeking to improve their performance.

Through events like the annual NASA/Contractors conferences which create a diverse knowledge and experience "data base," we can all hope to improve the vast range of components in national efforts to achieve performance excellence.

Not only do the attendees benefit from the intelligence gathered at this event, but the team of people from government, industry, and education who help plan and conduct the event, with the support of leaders in their organizations, gain valuable contacts in the quality and productivity arena who will serve as information and experience resources in the future.

The quality principles served by this event include education and training, communication, employee involvement and team work, strategic planning, top management leadership and support, and focus on the customer and partners.

Contact for more information:

Geoffrey B. Templeton  
202-453-8415



*NASA Deputy Administrator J.R. Thompson delivers the keynote address to open the two-day Sixth Annual NASA/Contractors Conference.*

ORIGINAL PAGE  
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## II. STRATEGIC PLANNING

### 10. AMES DISASTER ASSISTANCE RESPONSE TEAM

*Ames Research Center (ARC)*

Description of the Activity:

As a result of the actions of the Ames Disaster Assistance Response Team (DART) after the Loma Prieta Earthquake of October 17, 1989, further damage to the center was prevented, and the center was able to re-open for business much more rapidly than anyone thought would be possible. These accomplishments are the direct result of not only the competence and dedication of the DART, but vividly demonstrate the benefits of the investment made by Ames in providing the training necessary to establish a quality Disaster Assistance Response Team. The DART's training prepared them for more than they actually experienced during the earthquake. They would have been prepared for rescue and emergency medical treatment had it been necessary.

Benefits Achieved:

The tangible benefit to Ames of the DART's training, by preventing further damage to the center, would be in the millions of dollars. The intangible benefit was the ability of the center to re-open quickly and get back to doing its important research business.

The DART and its leader have been recognized for their accomplishments with their nomination for a NASA Group Achievement Award and an Exceptional Service Medal.

Contact for more information:

Joe Piazza  
415-604-5366

### 11. ONE-GYRO/FINE SUN SENSOR ATTITUDE CONTROL SYSTEM DEVELOPED

*Goddard Space Flight Center (GSFC)*

Description of the Activity:

A backup attitude control mode, involving use of one gyro and both Fine Sun Sensors, has been developed for the IUE satellite. Testing of ground-system and on-board computer software is being performed on the simulator. Mapping of the aperture plate was undertaken in order to locate all the holes and apertures accurately. This is necessary to permit the new FES-controlled slews that will permit target acquisition.

### Benefits Achieved:

The backup control mode should permit the satellite to continue obtaining useful scientific data in the event of a gyro failure.

Contact for more information:

Don West  
301-286-6901

## 12. AUTOMATIC PLANNING OF SPACECRAFT ACTIVITY

*Jet Propulsion Laboratory (JPL)*

### Description of the Activity:

Spacecraft activity planning is the process whereby requests for spacecraft resources from scientists and engineers are integrated into a time-ordered schedule of events that can be used to assemble a stream of commands to the spacecraft. Traditionally, requests for spacecraft resources exceed availability. As a scheduler builds a time line, conflicts over resources must be resolved. Our goal is to provide an automatic planner that provides an initial recommendation for a resource allocation schedule in which conflicts have been reduced to some minimum level while still accommodating as many of the requests as possible. In addition, we have identified the need for a metric with which to measure the quality of the sequence produced by the actions of the automatic planning tool.

A selection of candidate methods to solve the planning problem was made and an initial specification for a metric was developed. An implementation of one of the methods, simulated annealing, was developed on the Caltech/JPL MarkIIIfp Hypercube and Inmos Transuter ensemble mounted in Sun Microsystem's 386i Workstation.

### Benefits Achieved:

- 1) The automatic planning capability, when integrated into the SFOC spacecraft sequencing program, will significantly decrease the time required to produce an acceptable sequence for flyby and orbiting spacecraft missions.
- 2) The automatic planning techniques can be extended to support onboard planning for fairly autonomous planetary vehicles on the Moon or Mars.

Contact for more information:

Carol Collins or Barbara Zimmerman  
818-354-0157 818-354-6700

### 13. STRATEGIC MANAGEMENT OF TECHNOLOGY

#### *Johnson Space Center (JSC)*

##### Description of the Activity:

Responding to JSC's strategic planning process in October 1987, and through the auspices of the center's recently instituted New Initiatives Office, the center has recently established the following systematic approach to facilitate the management of technology initiatives:

1. A Technology Coordinating Committee is a standing committee and comprises senior management staff from across all areas of the center. This committee has the responsibility for: (a) defining, coordinating, and implementing technologies across directorates; (b) assessing technology requirements and advocating new technology programs to NASA Headquarters; (c) recommending facilities and training required to support technology programs at JSC; (d) facilitating transfer of technology to space systems; and (e) initiating and maintaining effective working relationships with universities, industry, DOD, and other NASA centers.
2. Special Emphasis Technology Teams are ad hoc teams of individuals from all organizational levels representing technology areas identified as critical to the interest of our center's future. Teams operating to date include: (a) Mission Automation; (b) Regenerative Life Support; and (c) Human Performance. The teams are responsible for assessing and prioritizing areas of emphasis in each technology, and designing implementation plans for JSC technology development.

##### Benefits Achieved:

By forming teams and committees of individuals who share commonalities in technology development, the approaches have opened communication channels throughout the center across functional lines.

This process has resulted in a greater understanding between technology developers and users. Individuals within the center have been able to combine their insights to coordinate and prioritize technological thrusts. By focusing efforts in critical technology areas and consolidating similar or redundant efforts, there is more effective integration of technology resources and more effective planning for those technologies vital to JSC's future.

Contact for more information:

Lyn Gordon-Winkler  
713-283-5400

#### 14. NASA DATAPoint OFFICE AUTOMATION PROJECT PHASED OUT

Kennedy Space Center (KSC)

##### Description of the Activity:

The NASA Datapoint Office Automation System began as a pilot system to be used until KSC procured a centerwide office automation system - Alis. Due to the immaturity of the Alis software, the requirement to sustain the Datapoint was extended.

Since the Alis product has matured over the past several years, the requirement to maintain the Datapoint System has been eliminated. All original Datapoint users were transitioned to Alis or some alternate office automation system by August 1989. This provided a transition time until the Datapoint System was shutdown on December 21, 1989.

##### Benefits Achieved:

In 1989, the Datapoint System required the support of one person and yearly hardware and software maintenance costs of \$70,925. By terminating the Datapoint System, these costs will be eliminated. In addition, SI-CSD will no longer be supporting the office automation systems for KSC.

Contact for more information:

Susan L. Hutchison  
407-867-4756

#### 15. DISTRIBUTION LOCALLY OF UPDATED CENTER MISSION AND GOALS

*Langley Research Center (LaRC)*

##### Description of the Activity:

Each employee received the above mentioned brochure which is a result of the ongoing strategic planning process at LaRC. Monthly sessions are held with senior management together with two-day sessions held off-site twice a year to focus on the center Technical Programs and the resources required.

##### Benefits Achieved:

A timely exchange of information is provided for a clear focus on the agreed upon priorities. Directorate heads can better serve as a "board of directors" for the center in conducting the research activities.

Contact for more information:

Sidney F. Pauls  
804-864-6113



Langley  
Research  
Center



*Each employee at Langley received this brochure of updated Center Mission Goals which are a result of the Center's strategic planning and review program.*

## 16. NEW APPROACH TO ADP PLANNING AT LEWIS

*Lewis Research Center (LeRC)*

### Description of the Activity:

Motivated by the knowledge that meeting the center's most important short- and long-term goals requires excellence in ADP, the Computer Advisory Board (CAB) approached this year's planning process from a new perspective.

Replacing the mainly budget driven approach of the past, the CAB coupled the plan closely to programmatic requirements, taking into account both cost and performance effectiveness. High performance computing was viewed as the plan's critical element for supporting advances in aerospace science and engineering. After senior management approved the plan, Implementation Guidance Teams were formed which include representatives from Computer Services, users, and industry. The teams assist line management in implementing the higher level Lewis ADP Plan. Each team focuses on one major functional area, such as business or communications and networking.

### Benefits Achieved:

While the center's centralized systems remain essential, the computing environment includes an increasing number of users with distributed computing systems for specific computing needs. This situation emphasized the need to integrate hardware, software and people to achieve a productive environment. The closer tie to programmatic requirements and vision for high performance computing will benefit space propulsion, a planned major growth area at Lewis, and will help make projects like NPSS possible (Numerical Propulsion Simulation System, which uses integrated, multi-disciplinary analysis to significantly reduce the time needed to design a superior aircraft engine).

Contact for more information:

Les Nichols  
216-433-3213

## 17. TQM IN ADVANCED LAUNCH SYSTEM PROGRAM

*Marshall Space Flight Center*

### Description of the Activity:

The Advanced Launch System (ALS) Program has adopted Total Quality Management (TQM) tenets from the outset. Specific attention has been addressed to strategic planning and employee training. The planning effort has focused during Phase I and II on ensuring the requirements and design concepts are based on cost effectiveness. Employee training has included attendance at various seminars and training programs including all senior managers completion of Dr. Deming's programs. Engine definition process has focused on vehicle (customer) requirements.

### Benefits Achieved:

The Phase B Engine Statement of Work has been specifically structured for TQM. Quality functional deployment reviews have been conducted with design contractors. Cross functional communication have been enhanced by multi-functional group participation in the requirement and program structure decision processes.

Contact for more information:

Ralph Hoodless  
205/544-1890



## 18. OFFICE FILE SEARCH AND RETRIEVAL SYSTEM

*NASA Headquarters (Code GK)*

### Description of the Activity:

Since NASA's inception, the Office of General Counsel's files have been maintained in various locations and, frequently filed under more than one subject heading. In 1989, we established a computerized database for these files, which when fully loaded, will permit the attorneys, from their desktop computers, to conduct a full-text search of this 30 years of precedent and prior research for any legal issue in any of these documents regardless of how they were filed or indexed. Additionally, statutes and cases cited in the memoranda can be quickly checked to assure that they remain valid. Finally, documents relevant to the issue at hand can be easily retrieved from the data base.

### Benefits Achieved:

This system permits rapid and complete access to any precedent or prior research in more than 30 years of files. Additionally, the system:

- 1) reduces file storage space;
- 2) eliminates the need to maintain a file index system;
- 3) makes finding information much easier and faster;
- 4) completes much more exhaustive searches;
- 5) immediately determines whether cited authorities have been affirmed, distinguished, modified, or overruled; and
- 6) permits accurate (electronic) reformatting and incorporation of retrieved data into current work.

Contact for more information:

Donald Becker  
202-453-2440

### III. FOCUS ON CUSTOMER

#### 19. GODDARD EMERGENCY RESPONSE TEAM (GERT)

*Goddard Space Flight Center (GSFC)*

Description of the Activity:

In 1989, the Health and Safety Branch, Code 205.2, established the Goddard Emergency Response Team (GERT). The GERT is a team of three personnel tasked with initial response and mitigation of emergency incidents, such as ambulance, fire, rescue, or hazardous material calls.

Team members provide initial assessment and action on the scene, assisting fire department personnel in proper utilization of resources. The fire department provides ambulance transportation, and the center avoids the cost service, while obtaining better emergency medical care. In other emergencies, the team notifies the fire department to respond with only the necessary apparatus. This method provides the best service for Goddard, reduces unnecessary apparatus. This method provides the best service for Goddard, reduces unnecessary media attention, and allows the Fire Department to better use its resources.

Benefits Achieved:

In its first year, the GERT responded to more than 50 emergency calls. The GERT Standard Operating Procedures were approved by the Center Director. In addition, the GERT has provided standby support for hazardous operations, and support of NASCOM shuttle operations.

Contact for more information:

John Frey  
301-286-9361

#### 20. NASA PROPERTY DISPOSAL MANAGEMENT SYSTEM (NPDMS)

*Goddard Space Flight Center (GSFC)*

Description of the Activity:

In October 1985, the Goddard Space Flight Center was asked by NASA Headquarters to lead the preparation of a plan for developing a standardized automated property disposal management system. GSFC had the only fully automated property disposal management system that interfaces with the NASA Equipment Management System (NEMS) and the General Services Administration (GSA). Therefore, this system was chosen as the development baseline of the standardized program.

The Goddard Development Team submitted an Implementation/ Maintenance Proposal to Headquarters for this project. It was accepted and Goddard will assist each NASA center implement this system. The GSFC NPDMS team has continued to provide on-site user training for this system. NPDMS has now been installed at Goddard, LeRC, KSC, JSC, and Ames.

Benefits Achieved:

NPDMS increases productivity by:

1. providing direct, automatic interface with GSA data bases, thus significantly reducing labor intensive reporting;
2. eliminating manual logs; and
3. providing standardized retrieval methods, which increase the capability to screen equipment records.

Contact for more information:

Connie Higgs  
301-286-5912

## 21. AUTOMATED COMPONENT PARTICLE COUNTER

*Jet Propulsion Laboratory (JPL)*

Description of the Activity:

An electronic particle counter was installed in Building 113, Room 120, Component Cleaning Facility flow bench.

Benefits Achieved:

The electronic particle counter replaces manual particle counting with a microscope. The electronic counter covers a particle range from 5 microns to 200 microns and requires four minutes per sample (four times faster than manual counting). The end result is increased cleaning facility output with more accurate and more repeatable particle counts.

Contact for more information:

Darrell Schmit or Willard Andrews  
818-354-7295      818-354-4641

## 22. SUPPLIES AND SERVICES ACQUISITION SYSTEM

*Jet Propulsion Laboratory (JPL)*

### Description of the Activity:

On July 24, 1989, the first phase of the Supplies and Services Acquisition System (SAS) became operational. The first phase involved the implementation of the Purchase Order with a Millennium software module developed by McCormack & Dodge. The module was tailored to meet JPL's requirements for requisitioning, ordering, and receiving functions. Later phases of SAS will provide the paying and the inventory control functions.

### Benefits Achieved:

The SAS provides an on-line environment where authorized users can access up-to-the-minute information on the status of requisitions, purchase orders, contracts, and related receiving activities. Reports provide more timely and accurate information for procurement administration and management, and can be more easily modified to meet the users' specific requirements than with JPL's previous system. Data is input only when a transaction is initiated, thereby reducing the number of times it is handled, which, in turn, reduces the opportunities for errors. As users become more experienced with utilizing the SAS system, additional benefits will be identified and documented.

Contact for more information:

Marc Montgomery  
818-354-9843

## 23. UPGRADE OF INSULATION VULCANIZATION CAPABILITIES

*Jet Propulsion Laboratory (JPL)*

### Description of the Activity:

A state-of-the-art autoclave (5-ft. diameter x 8-ft. deep) was installed for operational refurbishing of test hardware and R&D insulation at the JPL Edwards facility.

### Benefits Achieved:

Cost and time savings have been realized in performance refurbishment work required between motor firing because we do not have to send hardware out to vendors. This also provides the capability to support the ASRM Program's asbestos-free insulation program more effectively and will allow more effective support to MSFC on insulation programs in the future.

Contact for more information:

Robert Thompson  
818-354-3575

#### 24. DEVELOPMENT AND PRODUCTION OF "DISCOVER THE VALUE"

*Kennedy Space Center (KSC)*

Description of the Activity:

"Discover the Value," a professional quality videotape, provides identity to the centers for Commercial Development of Space (CCDS) network, establishes a CCDS logo, and clarifies the progression from laboratory to space. The video and four-page handout (available on hard copy or floppy disk) underscore the assistance available to customers from the CCDS and NASA.

Benefits Achieved:

Commercial payload developers are provided with an overview of KSC processing and NASA experience in a variety of disciplines. This knowledge enhances understanding and ability to effectively work with NASA systems.

Contact for more information:

Priscilla Elfrey  
407-867-3374

#### 25. ASSESSMENT SURVEY ON CENTER NEEDS FROM PERSONNEL DIVISION

*Langley Research Center (LaRC)*

Description of the Activity:

A Langley Improvement Team (LITES) was tasked to find ways to improve the services provided by the Personnel Division. The team members met several times with technical assistants and administrative assistants from each of the center's directorates to survey and assess their directorate's needs. The team analyzed the problems identified from the survey and developed a plan of action to streamline and/or eliminate those problems.

Benefits Achieved:

The Personnel Division now is providing better support in a more efficient manner. Time is saved due to the more efficient approach to the services provided by the Personnel Division's employees. These improvements in operations are making for more satisfied customers.

Contact for more information:

Elaine Gause  
804-864-2553

## 26. NASA/AHS ROTORCRAFT NOISE REDUCTION PROGRAM

*Langley Research Center (LaRC)*

### Description of the Activity:

The NASA/AHS Program is a focused, integrated effort. The focus is to develop the necessary technology to enable industry to design and build quiet and efficient rotorcraft. This program consists of integrated NASA-sponsored research with four helicopter airframe companies and company-sponsored research. The government rotorcraft research centers are interacting with industry for both technical interchange and cooperative efforts.

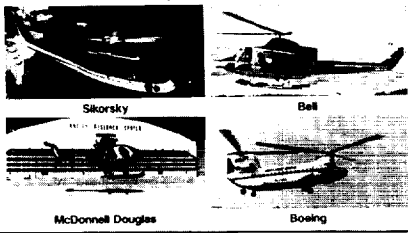
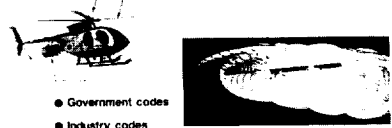

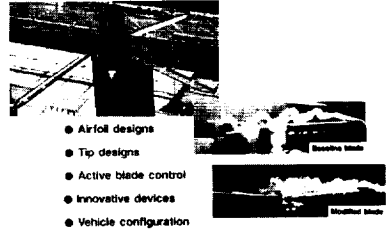
### Benefits Achieved:

The program has been extremely successful in developing new capabilities in the industry, in sharing noise technology between companies, and in transferring NASA-developed technology into the companies. Semi-annual, formal research reviews and data exchanges, as well as informal exchanges on an as required basis, have led to significant advances in rotorcraft aeroacoustics technology, without duplication of effort. Additionally, where appropriate, the best capabilities of one group were integrated with that of another group, thus providing superior quality research with efficient use of resources.

This approach made possible the definition of rotor noise sources, the prioritization of noise sources, the use of high quality extensive acoustic data bases for research purposes, and the development of aeroacoustic prediction codes. System noise prediction codes are being developed and integrated into a design for noise capability. Additionally, noise reduction concepts have been identified and are being evaluated.

Contact for more information:

Otis Childress  
804-864-5278

<b>NASA/AHS PROGRAM ACCOMPLISHMENTS</b>	
<b>NASA/AHS PROGRAM</b>  <p>Sikorsky Bell McDonnell Douglas Boeing</p>	<b>BUILT COMPREHENSIVE NOISE PREDICTION CAPABILITY</b>  <ul style="list-style-type: none"><li>● Government codes</li><li>● Industry codes</li><li>● Rotonet-Industry participation</li><li>● Extensive flight and wind tunnel validation</li></ul>
<b>ENHANCED ROTORCRAFT ACOUSTICS RESEARCH INFRASTRUCTURE</b>  <ul style="list-style-type: none"><li>● Increased staff</li><li>● Increased research capability</li><li>● Increased management awareness</li><li>● Sharing of research results among participants</li></ul>	<b>DEVELOPED NOISE REDUCTION TECHNOLOGY</b>  <ul style="list-style-type: none"><li>● Airfoil designs</li><li>● Tip designs</li><li>● Active blade control</li><li>● Innovative devices</li><li>● Vehicle configuration</li><li>● Understanding of physics</li></ul>

*Langley Research Center and four helicopter airframe companies integrate technology development efforts to enable industry to design and build quiet and efficient rotorcraft.*

## 27. ADMINISTRATIVE PROCESS IMPROVEMENTS

*Lewis Research Center (LeRC)*

### Description of the Activity:

New and innovative ways of doing business in non-technical areas, from finance to procurement to information services, are essential to improving service to internal and external customers. Examples from 1989 include:

- An unprecedented trade and barter of surplus NASA equipment was exchanged for the launch services of two Atlas/Centaur (A/C) launch vehicles. Surplus Atlas/Centaur and Shuttle/Centaur flight and nonflight equipment, tooling, and facilities were exchanged for a credit of approximately \$83 million. The credit was applied against the rebuild and launch of AC-68 and launch services for the CRRES mission in June 1990. No additional appropriated funds were required for rebuild and launch of AC-68 (\$18M) or launch service for CRRES (\$65M). Numerous procurement, property, and legal issues were resolved to complete the transaction.

- The Photographic and Printing Branch installed a non-conventional photographic printing system, the Ilford Cibacopy. This system allows the photolab to produce high quality prints and viewgraphs from original media without the use of negatives.
- Parallel testing of an Electronic Timesheets (TADS) system began in November. The system was the result of efforts by a cross-functional team which identified applications, developed requirements, and identified training needs.

#### Benefits Achieved:

As a result of the trade and barter agreement, NASA will no longer provide funds for equipment maintenance to the five contractors involved. Also, a government property accountability program will not be required. Both of these areas will result in substantial NASA, GSA, and DCAS manpower savings.

The Ilford Cibacopy has decreased production time by 50 percent. Currently, 25 percent of the work is handled by the new system; by the end of this year, this will increase to 40 percent.

The TADS system allows for faster receipt of time and attendance sheets in the Payroll Branch, and quickly identifies missing reports. System checks decrease the need for detailed audit of timesheets by payroll clerks.

Contact for more information:

Richard Clapper  
216-433-2890

#### 28. HITEMP ADVISORY COMMITTEE

*Lewis Research Center (LeRC)*

#### Description of the Activity:

The HITEMP Advisory Committee was established by Lewis to review research programs directed toward developing composite materials for 21st century aircraft engines. The committee comprises representatives from five aerospace companies which participate in the comprehensive three-day project review every year. Results of this confidential review are shared with Lewis managers and employees, and a response is provided to the committee indicating how their input will affect the programs.

The HITEMP Advisory Committee reviews differ substantially from peer reviews which assess every research area at the lab approximately every five years. The committee represents industry customers only and maintains a project focus as opposed to emphasizing the fundamental research science. Input from the committee also reflects their companies' position in addition to personal evaluations.



### Benefits Achieved:

The HITEMP Advisory Committee reviews inject realism and a customer focus into the research process at a very early phase; looking at potential technology applications while fundamental research is still underway. The reviews ensure that the research being done will achieve the maximum scope and impact possible for the eventual customers.

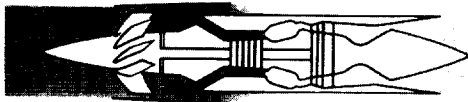
While the actual research is high risk and eventual results cannot be predicted, the reviews help Lewis focus on the areas of greatest interest to industry.

Contact for more information:

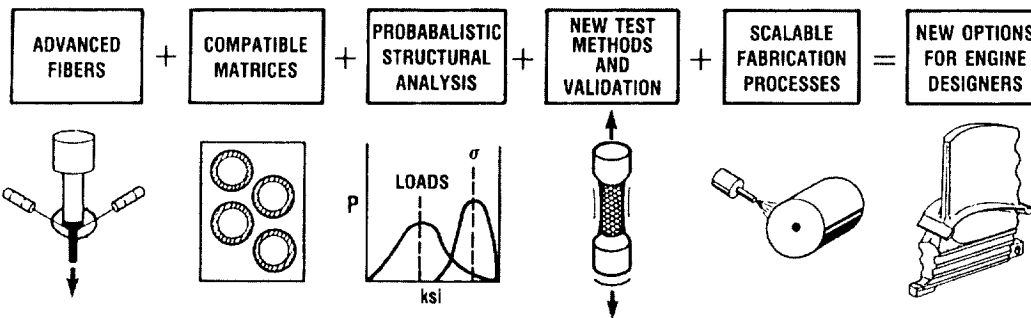
Joseph Stephens  
216-433-3195



## **ADVANCED HIGH TEMPERATURE ENGINE MATERIALS TECHNOLOGY PROGRAM**



**A FOCUSED RESEARCH PROGRAM TO  
CREATE AND VALIDATE THE NECESSARY  
REVOLUTIONARY MATERIALS OPTIONS  
AND STRUCTURAL MODELS FOR  
21st CENTURY AIRCRAFT ENGINES**



**POLYMERIC COMPOSITES TO 800 °F  
METALLIC COMPOSITES TO 1800 °F  
INTERMETALLIC COMPOSITES TO 2300 °F  
CERAMIC COMPOSITES TO 3000 °F+**

CD-89-40860

*The Lewis HITEMP Advisory Committee guides early phases of research in materials development for 21st century aircraft engines. This orientation to the future ensures maximum potential is realized.*

## 29. COMPUTER INTEGRATED MANUFACTURING

### *Marshall Space Flight Center (MSFC)*

#### Description of the Activity:

A complete Computer Integrated Manufacturing (CIM) capability was developed for complex machining required in fabrication of flight experiment hardware. MSFC had all components of the CIM system, but the software subsystems had not been integrated. Post processor software was generated and modified, and machining tests were performed until a successful translation of computer data was made from the computer design terminal to the milling machine. This provided highly accurate numerically controlled machining with no numerical tape.

The prior method of programming required point-by-point input of data necessary to define lines, arcs, and holes. This data was code punched into numerical tape which was physically loaded into the machine controller. The accuracy of curved cuts made by the machine was controlled by the number of input points.

Using the CIM techniques, the computer toolpath software calculates and stores as many points as are needed, and the programmer identifies the curve and the computer does the rest. Experience and proficiency with numerical control toolpath generation software was acquired as part of this new capability development, and using CIM makes design or manufacturing changes simpler and less time consuming.

#### Benefits Achieved:

This computer integrated manufacturing capability makes programmed machining more efficient and accurate. Programming time is greatly reduced and accuracy is increased by the large number of input points generated by the computer. Changes in part design can be accommodated more efficiently. In addition, this system is more versatile than the old system. Very complex parts can now be manufactured that would otherwise have been impossible or impractical to produce. The direct link between design and manufacturing results in more interaction between design engineers and manufacturing personnel; therefore, the designer gains experience in manufacturing techniques, which he can apply in future design work, and the manufacturer has needed input into the design.

Contact for more information:

Kevin Ward or Ricky Middleton  
205-544-1091 or -7025

### 30. DEVELOPMENT OF VACUUM PLASMA SPRAY TECHNIQUES FOR SSME MAIN COMBUSTION CHAMBER LINER FABRICATION

*Marshall Space Flight Center (MSFC)*

#### Description of the Activity:

The Vacuum Plasma Spray Cell of the Productivity Enhancement Complex is being utilized in an S&E-wide cooperative effort to develop new fabrication procedures for Main Combustion Chambers (MCC) to be used in the Shuttle and Advanced Launch System (ALS) programs. A NARloy-z MCC liner and cooling channel closeout will be vacuum plasma sprayed inside a cast jacket. This project emphasizes concurrent development of design, fabrication process, and non-destructive examination techniques. The cooperative effort encompasses a number of separate Materials and Processes Laboratory divisions as well as the Propulsion and Structures and Dynamics laboratories.

#### Benefits Achieved:

The new method offers significant reductions in MCC cost and fabrication time and increased reliability. Cost savings are estimated to be at least \$1.7 million per engine. Fabrication time can be reduced from the current four years to one year or less. Vacuum plasma spray of the liner inside the intact jacket will allow the manifolds to be cast as part of the jacket, thus eliminating blind welds which can lead to criticality-1 failures.

Contact for more information:

David Burns  
205-544-4807

### 31. VACUUM PLASMA SPRAY APPLICATION OF COPPER COATING ON SSME HPFTP TITANIUM MAIN FUEL VALVE HOUSING

*Marshall Space Flight Center (MSFC)*

#### Description of the Activity:

A vacuum plasma spray process developed in MSFC's Process Enhancement Complex will solve one of Rocketdyne's "Top Ten" problems in the manufacture of the Space Shuttle Main Engine (SSME).

The process uses Vacuum Plasma Spray to apply copper onto the SSME Titanium Main Fuel Valve Housing (MFVH) to form the tie-in for the electrodeposited nickel plate insulation closeout. The previous application method (air plasma spray) often resulted in a coating that peeled readily. On the average, three air plasma spray applications were necessary to achieve one acceptable coating. In contrast, the VPS copper coating is so tenacious that it can be removed only by machining. Final approval has been given to Engineering Change Proposal number 1074 authorizing the use of the Vacuum Plasma Spray (VPS) process.

Benefits Achieved:

The first two VPS sprayed MFVHs will be produced early in 1990 and installed on engines numbered 2034 and 2035. Use of the VPS coating process has saved an estimated \$76,000 per engine, or \$5.8 million per 100 mission model.

Contact for more information:

David Burns  
205-544-4807

32. HEADQUARTERS EXCESS HOLDING FACILITY ESTABLISHED

*NASA Headquarters (Code DBE)*

Description of the Activity:

In October 1989, Headquarters opened an excess holding facility to stage equipment, furniture, and supplies that have been declared excess and are waiting pickup by GSFC.

Benefits Achieved:

By using this holding facility, we can move excess items from customers' offices and hallways in three days rather than the 60-90 days it used to take. This rapid removal of excess reduces safety hazards and losses, and provides a clutter-free environment for our employees. In addition, by having one central location where we can stage excess furniture and equipment, we are now able to re-utilize many more items at Headquarters. This will save us costs of purchasing new items.

Contact for more information:

Christine Williams  
202-453-1810

33. HEADQUARTERS SUPPLY SERVICE CENTER

*NASA Headquarters (Code DBE)*

Description of the Activity:

In early 1990, Headquarters will open an on-site supply service center. This center will stock frequently used office supplies.

Benefits Achieved:

The supply service center will allow Headquarters to provide the most needed supply items to employees immediately. Currently, all supply items come from GSFC or are purchased from Small Purchasing. When emergencies occur (usually several times a week), our only option was to send a truck and driver to GSFC or initiate an emergency procurement. Both of these are expensive options.

This stock room will also enable us to distribute items in more economical quantities and purchase items at cheaper bulk quantity rates.

Contact for more information:

Christine Williams  
202-452-1810

34. NASA SUPPLEMENT RE-WRITTEN AND CENTER PROCUREMENT CLAUSES REVIEWED

*NASA Headquarters (Code HP)*

Description of the Activity:

The procurement policy office extensively rewrote the NASA Federal Acquisition Regulation Supplement to improve its clarity and readability. All legal and other regulatory citations were checked for accuracy and consistency with statute and legal decisions pertaining to federal laws affecting government procurement. More than 1,000 solicitation and contract clauses were examined and verified for accuracy and consistency with federal acquisition regulation. The office then determined whether the clauses required publication in the federal register for public comment prior to their continued use.

Benefits Achieved:

Rewriting the NASA FAR Supplement and reviewing local center clauses resulted in a significantly improved set of guidelines for managers in the acquisition process to follow when conducting NASA's complex procurement actions. Centers were able to share information about approaches that had been developed in solving contracting problems. The reviews assured that NASA procurement organizations were not duplicating efforts or contradicting regulations and statutes. The reviews improved the NASA community's collective procurement knowledge and contracting quality.

Approximately 80 percent of the NASA FAR Supplement was edited or rewritten, reducing the number of regulations by about 15 percent. Of 1,029 solicitation and contract clauses, 245 were determined to be duplicative, unnecessary, or contradictory to higher regulation, and were deleted.

Contact for more information:

Thomas Whelan  
202-453-8251

### 35. NEW TECHNOLOGY/MODERNIZATION

*NASA Headquarters (Code L)*

#### Description of the Activity:

The Office of Communications (Code L) purchased, installed, and declared operational three Pitney Bowes 8230 automatic facsimile machines.

#### Benefits Achieved:

Each machine allows up to 99 locations to be programmed and automatically forwarded. Previous facsimiles operated manually and had to be programmed, sometimes taking up to 3 hours to complete the transmission. This task also needed the full attention of an individual to monitor and feed the document into the machine.

The addition of the 8230s not only increases productivity, but enables NASA Headquarters -- particularly the NASA newsroom, which disseminates press material to both international and national organizations -- to transmit and receive materials faster and more efficiently.

Contact for more information:

Dwayne Brown  
202-453-8956

### 36. EFFORTS TO INITIATE, COORDINATE, AND ACHIEVE A CONSOLIDATED SUPERCOMPUTER ACQUISITION

*NASA Headquarters (Code NT)*

#### Description of the Activity:

NTD initiated discussions with GSFC and LaRC resulting in adding LeRC's requirement for a supercomputer to an on-going GSFC acquisition. Code NTD identified the opportunity, the impediments to consolidating the requirements, coordinated the resolution of those impediments, and expedited the approval of a procurement authority delegation from GSA. These actions resulted in LeRC avoiding an \$80 million acquisition and permitted GSFC to leverage this additional unit to achieve substantial cost savings. This acquisition also broke the psychological barrier as NASA's first consolidated acquisition.

#### Benefits Achieved:

LeRC avoided conducting a complex acquisition; the estimated savings of personnel resources are \$1.5 million. Also, LeRC's supercomputer will be delivered 1-1/2 years earlier, thus accelerating R&D programs and reducing associated costs.

Contact for more information:

Donald Andreotta  
202-453-1775

### 37. RESTORATION AND MODERNIZATION OF NASA FACILITIES

*NASA Headquarters (Code NX)*

Description of the Activity:

A special category was established within the construction of facilities budget to restore and modernize NASA's aging facilities. Prior to this initiative, most construction funds went to build new capability with no attention to the preservation or enhancement of existing capability.

Benefits Achieved:

- Increased productivity of NASA wind tunnels.
- Improved equipment for researchers.
- Extension of useful life of very expensive capital equipment.
- Savings to taxpayers.

Contact for more information:

Ted Ankrum  
202-453-1965

### 38. QUALITY AND PRODUCTIVITY AWARENESS NEWSLETTER INFORMS NASA AND PARTNERS OF CURRENT TOPICS

*NASA Headquarters (Code Q)*

Description of the Activity:

The Quality and Productivity Awareness Newsletter, issued quarterly since October 1988 by the NASA Office of Quality and Productivity, is distributed to more than 21,000 readers nationwide in the NASA, contractor, supplier community. It is also available upon request to any interested parties.

This information vehicle is a compilation of articles on quality and productivity activities, initiatives, and results from NASA Headquarters, field centers, and contractors through their NASA field center focal points. The information contained is intended, in part, to inform all NASA team members of improvement or progress achieved in work processes.

Articles submitted highlight improvements, more efficient ways, or new approaches to a wide range of topics including: purchasing, administrative processes, scientific research, education and training, quality measurement, customer satisfaction, cost savings/avoidance, and any other element of NASA's many activities.

Articles also highlight quarterly events and future events relating to: employee or contractor recognition; centers receiving national quality awards; government or industry conferences in quality and productivity; NASA Employee Team activities; Headquarters sponsored conferences or seminars, and other upcoming opportunities for employees to learn more about quality and productivity.

#### Benefits Achieved:

A newsletter which brings such a broad scope of information to such a large and diverse audience creates a sense of unity in the pursuit of continuous improvements in quality and productivity. These issues deserve attention in every aspect of NASA and contractor operations, and the experiences of any team member deserves sharing so that others may benefit from them.

The newsletter is also an effective communication tool for NASA management to communicate messages on quality and productivity issues to field centers and the contractor community.

All employees of the NASA team (employees of NASA, contractors, subcontractors, and suppliers) share the common vision of achieving mission success. Information exchange and communication play a vital role to this success and the Quality and Productivity Awareness Newsletter is a mechanism by which team members can "trade notes" on their experiences.

Contact for more information:

Geoffrey B. Templeton or Lynne M. Stewart  
202-453-8415



#### IV. EMPLOYEE TRAINING AND RECOGNITION

##### 39. FULL-SCALE AERODYNAMICS RESEARCH DIVISION HOLDS ANNUAL RECOGNITION AND AWARDS CEREMONY

*Ames Research Center (ARC)*

###### Description of the Activity:

The Full-Scale Aerodynamics Research Division has established an annual recognition and awards ceremony to give personnel in the division appropriate acknowledgement for their contributions to the success of the organization. At the event:

1. The Division Chief gives a welcome and state-of-the-division address listing the year's accomplishments and the outlook for accomplishing center and agency goals.
2. One of the assistant chiefs recognizes those personnel who, during the year have received any cash awards or group achievement awards, or made other notable contributions.
3. Each of the four branch chiefs then gives peer awards to members of their respective branch and, in some cases, members of other branches within the division who have supported branch goals. These are peer awards and are selected by the branch members. Photographs are taken at the ceremony, and suitable awards or plaques are presented to the award winners. In one branch, an annual "Best Publication" is recognized.

###### Benefits Achieved:

This event solidifies the division and makes each member realize that he/she is a vital part of the overall team. The winners exhibit great pride and experience a feeling of unity from this ceremony. We feel this activity promotes two key TQM principles. It "creates an innovative and challenging team climate," and is participative management which increases individual/team contributions.

We are careful to make this event a positive experience. Directorate management is invited, and they come to lend support. We have light refreshments at the end of the program to give personnel a chance to talk with other members of the division.

Contact for more information:

Jerry Kirk  
415-604-5045

#### 40. GSFC'S OUTSTANDING CONTRACTOR CONTRIBUTION AWARD

*Goddard Space Flight Center (GSFC)*

##### Description of the Activity:

To recognize the contributions of GSFC's more than 300 small business contractors, a new, honorary award was established. Modeled after the NASA Excellence Award for Quality and Productivity for contractors, this award focused on small businesses and used a concise nomination process which evaluated contractors in four categories: company achievements, cost performance, technical innovation, and productivity management.

##### Benefits Achieved:

More than 25 companies responded to the first year's call. Four companies were selected for recognition. These companies' outstanding accomplishments and the center's public recognition of the successes of these companies serve as a model of excellence and motivation to other companies. This type of recognition motivates employees and helps promote the company for future business opportunities.

Contact for more information:

H. Wayne Boswell  
301-286-5026

#### 41. FORMAL SOFTWARE INSPECTIONS

*Jet Propulsion Laboratory (JPL)*

##### Description of the Activity:

Formal inspections were instituted to identify and eliminate defects early on in the software development life cycle. As part of the Software Product Assurance's technology transfer function, this effort has introduced modern inspection techniques to ten ongoing JPL projects and trained more than 650 JPL and NASA personnel in methods of formal inspections. Over 300 such inspections have taken place at JPL since March 1988.

##### Benefits Achieved:

Four major defects and 12 minor defects have been found on the average, per inspection, since March 1988 over the course of 300 inspections. (Major defects must be fixed immediately; if allowed to remain in a product, the system would not operate as required).

Contact for more information:

Marilyn Bush or John Kelly  
818-354-4495

## 42. ESTABLISHMENT OF JSC QUALITY PARTNERSHIP AWARD

### *Johnson Space Center (JSC)*

#### Description of the Activity:

The JSC Quality Partnership Award was established in October 1988. The award recognizes JSC employees and contractors not employed in safety, reliability/maintainability, and quality assurance disciplines for significant contributions toward improved quality of products, processes, and services. Individuals from both the civil service and the contractor community are nominated for the award by their colleagues, and recipients are presented with the quarterly award by the Center Director. The award has been presented to five recipients to date, ranging from contractors to NASA employees, and teams of employees from both technical and managerial disciplines.

#### Benefits Achieved:

This centerwide quality award has been strongly endorsed by the Director of JSC and the SR&QA Directorate which sponsors it. By visibly acknowledging those individuals committed to quality work, the award promotes a partnership relationship with SR&QA and supports the concept that "quality is built-in and not inspected-in."

The award recipients' achievements are extensively publicized through center newsletters. As a result of strong support by management, receipt of this award is considered significant, and has gained the interest of center employees. The promotion of the JSC Quality Partnership Award has increased the awareness of the need for all JSC and contractor staff to perform high quality work and to get the job done right the first time.

Contact for more information:

Harry Briggs  
713-483-4355

## 43. GENERAL SYSTEMS PROFILE

### *Kennedy Space Center (KSC)*

#### Description of the Activity:

Frank Johnson, of the Administrative Communications Staff, developed a technique for passively monitoring the administrative computer system's performance by compiling readily available system log data into performance metrics that accurately reflect historical resource consumption and using these metrics to project resource component shortages.

The technique depends on the development of a "General System Profile" which presents an overview of the performance of major system components and provides insight into the availability and consumption of these resources. A paper describing this concept was presented at a convening of the Computer Measurement Group's 1989 International Conference on the Management and Performance Evaluation of Computer Systems and was published in the group's 1989 Proceedings catalog.

Benefits Achieved:

NASA, KSC, and Frank Johnson received recognition by industry for contributing to increased knowledge within the computer performance measurements field.

Contact for more information:

J. Frank Johnson  
407-867-7040

#### 44. TRAINING NEEDS ASSESSMENT AND TEAM RECOGNITION CERTIFICATES

*Langley Research Center (LaRC)*

Description of the Activity:

The Training and Education Section conducted a centerwide employee training needs assessment. The results led to the development of a training catalog containing all the classes identified. The catalogs were sent to each employee, who in turn could request any class(es) desired. A decision to hold training on a specific subject depended on the number of requests for that class.

"Quality Circle Achievement Awards" and "Langley Improvement Team Achievement Certificates" were developed to recognize team members upon completion of their project. Coffee cups and lapel pins were also provided to the team members.

Benefits Achieved:

The training program is now more in-tune with the needs of Langley's employees. Training can now be scheduled in a more timely manner, thus, making budget more efficient.

The certificates have provided incentive for the team members. The recognition given to teams has enhanced the program by providing more visibility through the house organ, when reporting the awards activity.

Contact for more information:

Dr. Mary Lewis  
804-864-2596

#### 45. THRIVING ON CHANGE - A CONFERENCE FOR THE 90'S

*Lewis Research Center (LeRC)*

##### Description of the Activity:

Lewis sponsored a 20-session conference for employees and managers on building effective work relationships in a changing environment. The conference featured a keynote presentation on time management from Dr. Thomas De Coster, chairman of the Executive Education Program at Indiana University. Highlights of the conference included sessions on: The What, Why, and How of Creativity; Increasing Your Problem Solving Power (Advanced Creativity Techniques); Breaking the Cycle of Group Boredom, Burnout, and Complacency; Critical Thinking Skills for the 90's; Increasing Personal Effectiveness; Positive Management of Stress; and many others.

##### Benefits Achieved:

The conference provided employees with the latest strategies for individual excellence and organizational growth. In addition to educational workshops, the conference served as an interactive forum for networking with Lewis personnel and becoming acquainted with unfamiliar areas of the lab. It also provided an opportunity for discussions with conference consultants about quality and productivity initiatives undertaken in private industry.

Contact for more information:

Mary Kovach  
216-433-2994

#### 46. ROYALTY-SHARING PROGRAM FOR NASA EMPLOYEE INVENTORS INSTITUTED

*NASA Headquarters (Code GP)*

##### Description of the Activity:

As the result of recently enacted legislation, procedures have been implemented to pay at least 20 percent of the royalty income received from the licensing of NASA patented inventions. Correspondingly, a greater emphasis has been placed on the licensing of NASA inventions for commercial use on a royalty-bearing basis. The objective is to achieve more commercial use of NASA developed technology, and to recognize and reward those employees who contribute to the process.

### Benefits Achieved:

Royalty income of more than \$125,000 has been distributed to approximately 38 employees since the procedures have been instituted. In addition, during the same period, the number of inventions reported by NASA employees has significantly increased. Such increased reporting indicates greater employee involvement in the process, and provides a larger technology base for commercialization. Also, more and more companies are expressing an interest in commercializing NASA technology under patent license.

Contact for more information:

Harry Lupuloff  
202-453-2430

## 47. MANNED FLIGHT AWARENESS (MFA) PROGRAM

*NASA Headquarters (Code M)*

### Description of the Activity:

The Manned Flight Awareness (MFA) Program continues to be one of NASA's most successful, visible, and effective employee motivation programs. During 1989, the MFA Program sponsored two honoree events at the Kennedy Space Center for two planetary missions, STS-30 (Magellan) and STS-34 (Galileo). More than 500 honorees and guests from government and industry attended each of these events which included a tour of the KSC facilities and a reception held in their honor with senior NASA and industry management and members of the Astronaut Corps in attendance.

The program sponsored more than 240 astronaut appearances at NASA centers, contractor and subcontractor plants, and vendor facilities for motivational purposes and presentation of "Silver Snoopy" awards for outstanding performance in support of manned space flight activities. Motivational materials (posters, decals, etc.), including a special Apollo 11 20-Year Anniversary Pin and dedication signed by the NASA Administrator, were distributed to the NASA government/industry work force.

In 1989, the MFA Program introduced a new Flight Safety Award to recognize significant contributions by individuals who further NASA's flight safety efforts. In mid-January 1990, NASA's Flight Safety Panel presented awards to two Marshall Space Flight Center employees.

### Benefits Achieved:

The MFA Program ensures a high morale within the NASA work force and, through the joint participation of employees/management in all MFA activities, reinforces the important concept of teamwork.

Contact for more information:

Diana Chaney  
202-453-8642

48. NASA EXCELLENCE AWARD FOR QUALITY AND PRODUCTIVITY RECOGNIZES SUPERIOR CONTRACTOR PERFORMANCE

*NASA Headquarters (Code QB)*

Description of the Activity:

The prestigious annual NASA Excellence Award for Quality and Productivity recognizes NASA's aerospace industry contractors, subcontractors, and suppliers who consistently achieve the highest standards of performance and continuously improve the quality of their products and services.

The award was established in 1985, is managed by the NASA Quality and Productivity Improvement Programs Office, and is co-administered by NASA and the American Society for Quality Control to:

- increase public awareness of the importance of quality and productivity to the nation's aerospace program and industry in general;
- encourage domestic business to continue efforts to enhance quality, increase productivity, and thereby strengthen competitiveness; and
- provide the means for sharing the successful methods and techniques used by the applicants with other American enterprises.

Because maintaining effective and efficient practices that result in high levels of quality and productivity are a top priority at NASA, recognizing NASA/contractor team efforts in this area are a key element in jointly achieving excellence.

In the fourth annual NASA Excellence Award cycle, the only recipient named was the first **service** company ever in the Award's history to receive the honor. Lockheed Engineering and Sciences Company (LESC) of Houston, Texas, proudly accepted the "Oscar of the Space Industry" from NASA Administrator Richard H. Truly, at the company site on Dec. 5, 1989, with a gathering of 2,500 LESC employees on hand to share the pride expressed by LESC President Robert B. Young, Jr.

Admiral Truly commended Lockheed for instilling a culture that empowers and challenges people to take responsibility for quality. Lockheed supported NASA in the shuttle astronaut crews in earth observation activities, coordinating crew activities at Johnson Space Center with earth sciences community needs, and coordinating crew training and mission support. Lockheed also contributed to return-to-flight activities, including the shuttle crew escape system and the clam-shell fix on the nitrogen tetroxide leak prior to STS-26.

NASA Excellence Award nominees must thoroughly address the following criteria in their applications:

- Performance Achievements and Improvements
  - o Customer Satisfaction
  - o Quality and Productivity
  - o Productivity Levels or Trends
- Quality and Productivity Improvement Process Attainments
  - o Top Management Commitment and Involvement
  - o Q/PI Goals, Plans, Measures, and Dissemination
  - o Open Communication
  - o Training
  - o Work Force Involvement
  - o Award/Reward Recognition
  - o Health and Safety
  - o Involvement of Vendors in Q/PI

NASA Excellence Award recipients demonstrate to the Award Evaluation Committee and the Validation Team that they have effectively implemented these elements into their operations. Since 1985 five organizations have been selected as NASA Excellence Award recipients. These companies successfully substantiated their ability to meet employee and customer needs, and sustain performance excellence as part of their cultures.

#### Benefits Achieved:

Through each award cycle, NASA and contractors exchange information which communicates to industry the characteristics which NASA values and requires in a business relationship. Contractors, on the other hand, gain in-depth knowledge on how they can better serve their customer. Together, NASA and contractors work toward mission success.

The prestige associated with receiving this award or being named a finalist encourages organizations to adopt excellence and continuous improvement as their work ethic. Finalists and recipients can be proud of their outstanding achievements in going through the rigorous evaluation process.



Nominees have expressed many times over the years that what they learn by going through the process is a most valuable aspect of their participation. Knowledge they gain from this critical assessment process assists them in planning and prioritizing their organizational improvement efforts. American industry benefits through shared knowledge, which NASA strongly encourages, of lessons learned from organizations who have achieved tangible results from implementing various improvement plans.

NASA's missions benefit with an ever-improving supplier base which is continuously striving to meet the highest standards. NASA Excellence Award recipients have also initiated programs which saved NASA millions of dollars and man hours. In 1989, NASA saved more than \$5.3 million thanks to Award Recipient LESC's efficient consolidation of three contractor efforts into one.

Ultimately, the American people benefit. They can take pride in their national space program; a program that is built on outstanding efforts, by all who are involved, in quality, productivity, and excellence.

Contact for more information:

Geoffrey B. Templeton or Tony Diamond  
202-453-8415



*Admiral Richard Truly (right) presents the 1988/89 NASA Excellence Award for Quality and Productivity to LESC President Robert Young, Jr. Seated behind the podium (from left to right) are James Ehl, Deputy Administrator for Safety and Mission Quality; Daniel Tellep, Lockheed Chairman of the Board and CEO; Aaron Cohen, Director, Johnson Space Center; Spencer Hutchens, Chairman of the Board for the American Society for Quality Control; NASA Astronaut Don Williams; and Don Jones, President, Lockheed Technology Services Group.*

## V. EMPLOYEE EMPOWERMENT AND TEAMWORK

### 49. EMPLOYEE CROSS TRAINING

#### *Ames Research Center (ARC)*

##### Description of the Activity:

One of the problems in the staffing and management of NASA flight projects, particularly at Ames Research Center, is the lack of civil service manpower and the necessity of using that manpower in the monitoring of work done by support service contractors. Our inability to hire experienced engineers, due to a pay scale that isn't competitive with industry for our geographic area, results in a high percentage of our engineers coming to us fresh out of college. Utilizing these "fresh outs" in a contract monitoring type of position has two major drawbacks. First, they do not have the experience to properly monitor contract work which frequently results in the "blind leading the blind" syndrome with consequent engineering problems and cost overruns. Secondly, the "fresh outs" quickly lose interest and enthusiasm for "paper" engineering. They desire to "get their hands dirty," to actually design and build something.

Unfortunately, at Ames Research Center, the civil service engineering staff that does hands-on engineering is in a separate directorate, Engineering and Technical Services. Thus, the Space Life Sciences Payloads Office's program was keeping its young engineers motivated and providing them with useful experience.

The method we have developed is to matrix a new engineer to a Engineering and Technical Services branch for a 3-6 month stint. While there, the new engineer works alongside experienced Engineering and Technical Services engineers on a hands-on project that may or may not have any direct application to the Space Life Sciences Payloads Office activities.

##### Benefits Achieved:

After the 3-6 month stint, the Space Life Sciences Payloads Office engineer returns to us with valuable experience, some understanding of how Ames Research Center operates, and essential contacts in Engineering and Technical Services with whom he/she will work in the future on Space Life Sciences Payloads Office specific tasks. They also gain the knowledge that they have accomplished a "real" engineering task.

Engineering and Technical Services also benefits in that it gets additional manpower at no cost and is able to develop a new understanding of how to operate with an engineer who will be a future customer. We would also like to use this approach to revitalize Space Life Sciences Payloads Office engineers who, after several years on a project, may need a respite from the high pressure and paperwork of project life. A similar approach with the Life Science Division should also benefit Space Life Sciences Payloads Office scientists.

Contact for more information:

Kenneth Souza  
415-604-5736

50. CENTER DIRECTOR GROUP ACHIEVEMENT AWARDS

*Goddard Space Flight Center (GSFC)*

Description of the Activity:

Many accomplishments each year only happen because of the cooperation and team work of people from many organizations. Major program accomplishments, such as satellite launches, are often recognized, but the many support activities and institutional activities seldom receive the same recognition.

In FY89, GSFC Center Director Dr. John W. Townsend, Jr., issued a special awards call to recognize intra-directorate accomplishments. Directors of each organization who had employees contributing to a nominated achievement concurred in the nomination of the whole group. There were 26 nominated groups and 11 were selected; in total, 207 employees were recognized.

Benefits Achieved:

This awards recognition provided an additional opportunity to reinforce the value of cooperative activities and intra-directorate teams.

Contact for more information:

H. Wayne Boswell  
301-286-5026

51. VOYAGER NEPTUNE ENCOUNTER SCIENCE SUPPORT ACTIVITY

*Jet Propulsion Laboratory (JPL)*

Description of the Activity:

Development of a Voyager Neptune Encounter Science Support Activity (VNESSA) improved distribution and display of near-real-time science data for seven of the Voyager fields and particles instruments during the Neptune encounter. This support allowed fields and particles principal investigators and their teams to visualize science results of their experiments more quickly than had been possible for previous encounters.

### Benefits Achieved:

VNESSA exceeded expectations in providing improved support to the science teams for field and particles instruments. The science teams used VNESSA more heavily during the encounter than was expected. Written evaluations and subsequent oral and written feedback from the science teams indicate a high level of satisfaction with VNESSA's support.

The VNESSA-developed data displays were unexpectedly popular for correlating results from two or more instruments, and verifying the science team's own analyses. The availability of science data in real time made it possible for the scientists to analyze their data quickly and contribute efficiently to the daily science discussions during the encounter. The VNESSA system made immediate analysis of science data possible during the Neptune encounter, whereas it was available only after several weeks of effort following the Uranus encounter.

Contact for more information:

Patricia Liggett  
818-354-1414

## 52. EMPLOYEE GROUPS ACTIVE AT CENTER AND ORGANIZATION LEVELS

### *Johnson Space Center (JSC)*

#### Description of the Activity:

Employee groups are continuing to play increasingly important roles in centerwide and organizational activities. Among new employee involvement groups established in 1989 are the center's Threshold Group, and the Center Operations Directorate Engineering Standards Working Group (SWG). Activities and benefits of these groups are described as follows:

- 1) The Threshold Group is a unique centerwide organization open to newer JSC civil service professionals who are committed to JSC's and NASA's future and want to make contributions over and above their normal work responsibilities. Factors that led to this group's formation included: a growing population of young professionals; changing needs and interests of new employees; more active co-op and intern programs; and experience in the center's strategic planning activities. Threshold activities include: a peer advisory group; participation in the new-hire orientation program; development of a small Shuttle experiment; white-paper study groups; and seminars relating important space program issues. Threshold objectives include: providing a forum for educational opportunities; improving productivity at JSC; facilitating the development and motivation of a dedicated, innovative work force; retaining JSC's "corporate knowledge"; improving and promoting NASA's public image; and providing a setting to discuss, develop, and evaluate issues. Operational since May 1989, Threshold now involves approximately 200 JSC employees in its various activities.

2. The Engineering Standards Working Group (SWG) was established by employees in the Facility Development Division of the Center Operations Directorate to upgrade existing facilities engineering design standards and specifications. The SWG meets weekly with a standing committee of 10 engineers and architects to review progress on standards improvement tasks. The SWG is chaired by the manager, Technical Operations Office, and group members receive other division management support through their respective supervisors to accomplish the tasks. Because group members select the tasks they consider most important for action, the SWG represents a "grassroots" effort to improve facility design standards at the Johnson Space Center.

Benefits Achieved:

1. The Threshold Group benefits the center in a number of ways. Threshold provides another mechanism for senior staff to pulse the young people; prepares professionals for JSC's future; provides another resource to address diverse issues; increases cross-organizational interactions; makes more effective use of informal communication channels; and creates a more knowledgeable and motivated work force. In addition, there are a number of personal benefits to JSC employees, which include: opportunities to build peer relationships; increased career growth and development experiences; a chance to participate in shaping the future of JSC; and, an opportunity for increased work satisfaction and fulfillment by contributing to centerwide goals.
2. The SWG has demonstrated its usefulness to both its directorate and the center through its implementation of a systematic method of designing and upgrading center facilities. For example, the SWG created a 16-volume set of standard details, submaster specifications, design policies, and abbreviated specifications. Each volume follows the Construction Specifications Institute outline, and all design personnel and architect/engineer firms will refer to the standards of guidance during the design process. The details are also readily available for both the engineering and construction support service contractors.

To date, the SWG has developed 39 standard drawings, written five abbreviated specifications to improve the efficiency of the construction support services contractor, and adopted 29 engineering policy statements. All SWG actions which improve facility construction specifications are immediately implemented at JSC. These changes are also forwarded to the NASA specification known as SPECSINTACT. This effort represents a significant increase in the design quality of a design program worth more than \$100 million, and is estimated to translate into savings of more than \$1 million to the government.

Contact for more information:

Diane DeTroye  
713-483-5266

### 53. ORGANIZATIONAL GOAL-SETTING AND TEAM BUILDING RETREATS

#### *Johnson Space Center (JSC)*

##### Description of the Activity:

Approximately 25 organizations participated in goal-setting and team building retreats conducted by JSC's Human Resources Office during 1989. The retreats are intended to improve the overall effectiveness of center organizations by developing clear employee roles and organizational goals. This year's retreats focused on division-level management who were provided with information derived from a combination of employee surveys, individual interviews, and assessment tools. Human Resources facilitators then guided the organization through a step-by-step process of reviewing issues, setting priorities, developing action plans, and assigning responsibility for results.

##### Benefits Achieved:

The organizations participating in retreat activities have reported several benefits including:

- improved management planning and decision-making based on more pertinent and valid information and feedback within the organization;
- strengthened employee commitment resulting from involvement in priority-setting and decision-making process;
- increased communication and teamwork between management and employees;
- enhanced opportunity for attainment of organizational goals resulting from higher levels of commitment and agreement by employees;
- better defined roles due to less workload overlap and duplication of effort.

Contact for more information:

Diane DeTroye  
713-483-5266

### 54. PAYLOAD MANAGEMENT AND OPERATIONS (CM) EMPLOYEE ADVISORY GROUP

#### *Kennedy Space Center (KSC)*

##### Description of the Activity:

The CM Employee Advisory Group, consisting of 12 volunteer members, polled their fellow workers during the year about issues of concern. The advisory group then met with the CM director to discuss these concerns; e.g., smoking policy, parking spaces, awards, etc. The CM newsletter, "Payload Perspectives," was

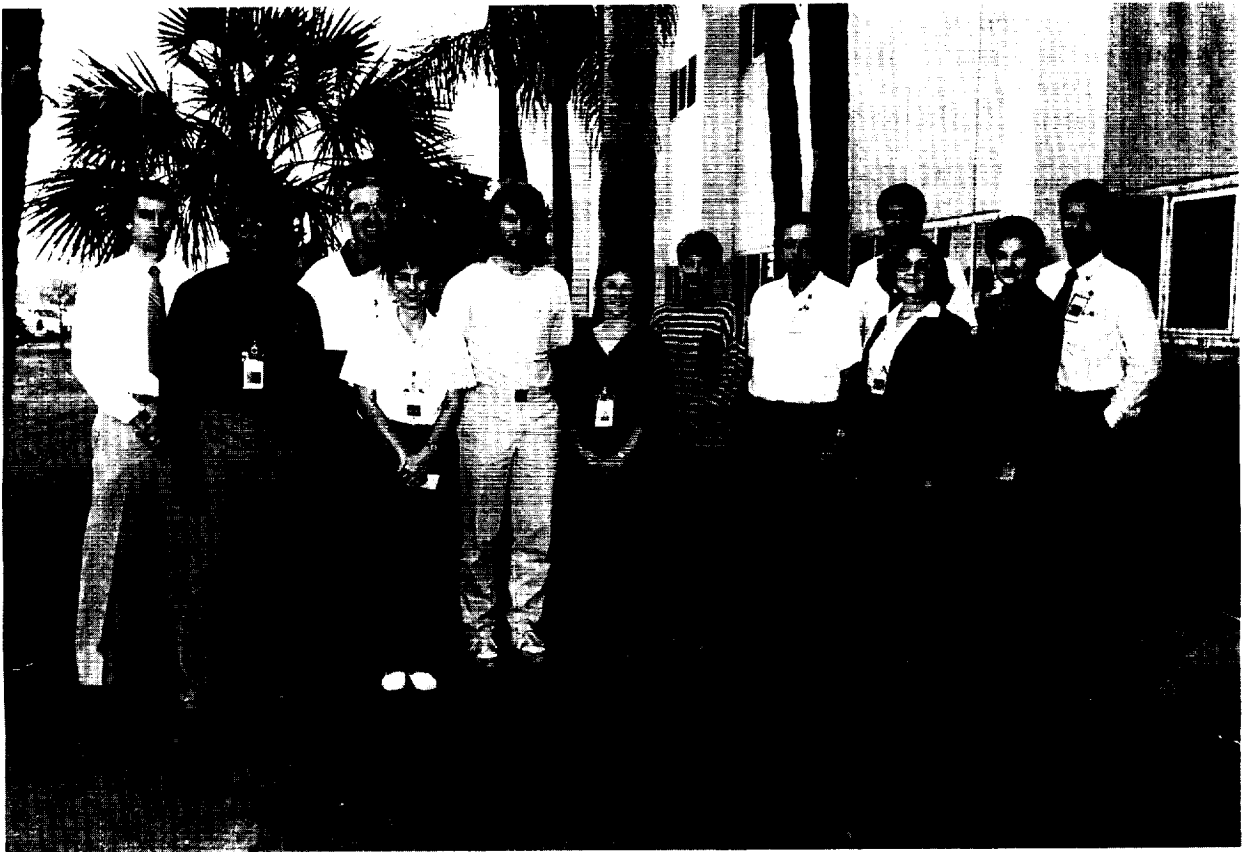
developed as a vehicle to disseminate the results of these meetings to the entire CM populace. Articles on new and current employees are featured in the newsletter along with the "Director's Corner," employees awards, current payloads/projects, and other motivating subjects. Three issues of the newsletter were published in 1989.

Benefits Achieved:

The CM Employee Advisory Group is providing employee feedback to management on key employee concerns. The group and their newsletter have helped to improve communication and develop a stronger feeling of camaraderie throughout the directorate.

Contact for more information:

Shirley Green  
407-867-3364



*The CM Employee Advisory Group at Kennedy Space Center advances employee involvement efforts: (from left to right) Mike Kinnan, Jerrace Mack, Jim Cottrell, Joyce King, Craig Jacobson, Shannon Potter, Bobbi Martin, Enoch Moser, Dale Stigberg, Shirley Green, LaVerne Dobbs, Craig Whittaker. Not Pictured: Bob Buck, Chuck Lynch, Pat McDonald, Darrell Thomas.*

55.           PROCUREMENT NET ESTABLISHES PROCEDURES FOR PROCESSING OF SMALL  
PURCHASE ORDERS

*Kennedy Space Center (KSC)*

Description of the Activity:

The Kennedy Space Center (KSC) Procurement NASA Employee Team (NET), PRO NETwork, was tasked to establish procedures for the preparation and processing of small purchase orders. This was a result of recommendations made by the team in their first management presentation. The team was formed to study procurement office problems and develop solutions. They then identified problems with timeliness in purchase order processing.

Benefits Achieved:

Through process flow analysis, data gathering from questionnaires and interviews of procurement personnel, site visits of selected areas involved in the flow, review of logbooks, and work simplification analysis, the team developed numerous recommendations, including the development of the procedures for small purchase orders. These recommendations were accepted by management and are currently being implemented.

Contact for more information:

Kim M. Lepore  
407-867-7217

56.   QUALITY CIRCLE IN CONTINUOUS OPERATION FOR 7-1/2 YEARS

*Langley Research Center (LaRC)*

Description of the Activity:

The Quality Circle, "Problem Seekers/Solvers," comprises engineering technicians assigned to the Operations Support Division. They are located in the Structures and Materials Division Laboratory. The "Problem Seekers/Solvers" was one of the original circles in Langley's Pilot Program that began in 1982. The circle has completed thirteen projects and more than 20 small tasks that were implemented by the members themselves. During the circle's existence, there have been four leaders, with a membership ranging from five to seven employees. The circle has received three "Quality Circle Achievement Awards" for their efforts.

Benefits Achieved:

The laboratory's operation has become more efficient since incorporating the circle's ideas and recommendations. The circle's recommendations have reduced safety hazards in the area. Participation in the circle has raised the employees' morale and productivity, thus benefiting the center. The employees appreciate having a say in the operations of their divisions.



Contact for more information:

Clarence Cole  
804-864-3292

## 57. NATURAL WORK GROUPS

*Lewis Research Center (LeRC)*

### Description of the Activity:

The Quality Circle program at Lewis has been evolving into a natural problem solving process. Over the past six years of program operation, more than 450 participants in 49 circles have received training in collaborative problem solving and decision making, meeting management, group dynamics and leadership techniques. Now, the process is being accepted as a normal way of doing business within and between work units, not limited to formal quality circles.

This transition happened gradually as managers became aware, through their own management programs and retreats, of the value of team problem solving techniques and consensus decision making. Managers have been putting their own teams together to solve problems using facilitation and skill building as appropriate. Currently, about 30 "Natural Work Groups" use a structured process and facilitation to improve organizational effectiveness, and many other groups are proceeding autonomously without outside assistance. Teamwork at Lewis has become a multi-faceted, institutionalized process with formal and informal circles, natural work groups, task teams, labor-management participation teams, and project teams.

### Benefits Achieved:

Team building, collaborative problem solving, and consensus decision making result in greater commitment to the center's goals, higher quality decisions, and removal of impediments to increased quality and productivity. By institutionalizing participation as a way of life, beyond the boundaries of a specific program, the scope and impact of these benefits becomes substantially greater.

Contact for more information:

Mary Kovach  
216-433-2994

## 58. THIRD ANNUAL NET RECOGNITION PROGRAM

### *Marshall Space Flight Center (MSFC)*

#### Description of the Activity:

The third annual NET Recognition Program at the Marshall Space Flight Center was held on June 13, 1989. Former Center Director, James R. Thompson, Jr., hosted a luncheon at the Redstone Officer's Club in honor of employees who were actively involved in productivity improvement at Marshall. Seventeen teams were honored for their initiatives in improving center operations.

Approximately 300 individuals attended the recognition event, a third of whom were supervisors. Opening remarks were made by William R. Reynolds, director of the MSFC Productivity Improvement Office. Mr. Thompson addressed the attendees regarding the MSFC NET process. He stated that, although the NET program was a comparatively young process, much has been accomplished in its first six years. He also noted that, "NASA projects - the ones that make headlines - are the Shuttle, Hubble Space Telescope, and Space Station. We don't read much about the NET projects in the newspapers,...but they are every bit as important to NASA's future and the future of the Marshall Space Flight Center..." He stated what excites him about the process are the projects, the accomplishments, and the overcoming of obstacles by a NET, which consist of a handful of individuals, with no budget, and yet, to whom schedule and project completion are important.

After his remarks, Mr. Thompson presented various awards which included Director's Commendations to individuals whose performance clearly exceeded normal expectations. Those who received the commendations were Raymond Spink of Aquanet, Jeanette Hall of Castnet, Jimmy Pruitt of "D" Team, M. Lee Membery of Fundseekers, Teresa Smith of Procurement/Legal, Frank Thomas of Networq, James McCarter of PD Originators, and Rosalynne Strickland of QTIP.

Four supervisors/managers were recognized with Center Director's NET Champion Awards. These managers not only supported the NET process by asking their people to become involved, but they also got involved with the team(s) themselves. The supervisors who received the awards were G. Porter Bridwell of the Shuttle Projects Office; Alex A. McCool of the Safety, Reliability, Maintainability and Quality Assurance Office; Allie C. Swann of the Financial Management Office; and Ann R. McNair of the Operations Development Division, Systems Analysis and Integration Laboratory.

Denise Braswell of SPACENET received the Douglas F. Sandridge NET Leadership Award which is presented annually to the NET leader who best exemplifies participative leadership.

Seven teams were nominated for the Center Director's Annual NET Award of Excellence. Three teams were selected by the MSFC NET Advisory Group as finalists for the award. The teams recommended were CASTNET, a centerwide team of clerical, administrative, and secretarial personnel, who developed a Ready Reference Manual for Clerical, Administrative and Secretarial Personnel; FUNDSEEKERS, a team of program/management analysts from the Institutional and Program Support Directorate and the Administrative Operations Office, who developed a training program for program analysts across the center; and ODDNET, engineers from the Systems Analysis and Integration Laboratory - Operations Development Division, who recommended a paper recycling program and conducted a paper recycling pilot in their division.

Based on 30-minute presentations by each of the three teams, the Center Director presented this year's Annual NET Award of Excellence to the CASTNET.

In addition, 12 teams and the team of eight part-time facilitators received Group Achievement awards. Mr. Thompson was presented with a special recognition award, and the employees involved in the NET process thanked Mr. Thompson for his continuous encouragement, outstanding support, and commitment to the process and its participants.

The keynote speaker for the program was C. Richard Hagener, of the Richard Hagener Corporation in Tacoma, Wash.

#### Benefits Achieved:

The CASTNET project, a Ready Reference Desk Manual for clerical, administrative, and secretarial personnel, was created to improve quality and productivity in the secretarial and administrative areas. The manual provides a single, centralized source where information can be obtained in an expeditious manner. The team has already provided 20 orientation sessions to various organizations throughout the center. Five hundred and fifty manuals have been distributed and are being utilized by employees across the center. The team has been highly commended by all levels of center personnel for its outstanding effort and accomplishment.

The Marshall NET process is in its sixth year and, to date, has saved the center approximately \$5.5 million in cost savings/cost avoidance.

Contact for more information:

Carolyn McMillan  
205-544-9523



*The MSFC NET Logo was unveiled at the NET Recognition program on June 13, 1989. This entry by NETWORK (NASA Employee Team Working on Restoring Quality) from the Structures and Dynamics Laboratory, Structures Division, won the logo competition.*

## 59. EMPLOYEE EMPOWERMENT AND TEAMWORK SYSTEMS DEVELOPMENT

*NASA Headquarters (Code M)*

### Description of the Activity:

- 1) Space Station Scheduling -- Two utility systems have been established in the Space Station Technical Information Management System (TMIS) network which allow TMIS users access to scheduling data. The Program Master Plan/Master Schedule (PMPMS) application provides detailed schedule and forecasting data on a monthly basis. The Scheduling Access and Reporting Application (SARA) allows TMIS users to view, print, and download Space Station schedule files for plotting purposes.
- 2) Consolidation of the Headquarters and National Space Transportation System (NSTS) budget data bases into a common system -- A "core data element" level of detail was identified which can translate into either the Headquarters or the NSTS formats. The projects report at this level, and the computer "maps" the data into the appropriate format for use by the analysts across Level I and Level II.
- 3) Connection of the Space Station Budget/Resources Information Management System (BRIMS) electronically into the TMIS network -- This allows the centers to electronically submit budgetary data consistent with the regular status submissions as opposed to a separate uplink via another network and system format.

Benefits Achieved:

- 1) Space Station Scheduling system enhancements of PMPMS and SARA allow for the discontinuation of hardcopy distribution of scheduling "blue books". These documents were often three inches thick with a distribution of more than 100 people.
- 2) Core data element reporting into the common (Headquarter's and NSTS's) budget data base eliminates countless hours of validation and error detection man-hour time.
- 3) The BRIMS electronic submission of Space Station budgetary data represents a significant improvement in overall resources labor.

Contact for more information:

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60. SUPPORT TO CENTER SRM&QA ASSESSMENT CAPABILITIES

*NASA Headquarters (Code QD)*

Description of the Activity:

NASA Headquarters, Data Systems/Trend Analysis Division, is supplying personal computer workstations to Safety, Reliability, Maintainability, and Quality Assurance (SRM&QA) offices at the NASA field centers. These workstations are being assembled and configured from personal computer hardware which has been turned in as excess equipment at NASA Headquarters. Seven workstations, including printers, were configured for use at the NASA field centers. Four were prepared for delivery to Stennis Space Center in Mississippi and three to Langley Research Center in Virginia.

Benefits Achieved:

The personal computer workstations will be used to access SRM&QA data bases such as the Significant Problem Reporting (SPR) system and NASA information systems such as the Program Compliance and Assurance Status System (PCASS). Staff will use the workstations to analyze problem data and determine the existence of any adverse trends. The workstations will also be used to prepare reports and graphic presentations to support decision-making processes.

Contact for more information:

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## VI. MEASUREMENT AND ANALYSIS

### 61. PROJECT MANAGEMENT INFORMATION SYSTEM

*Ames Research Center (ARC)*

#### Description of the Activity:

The Project Management Information System (PMIS) is a Decision Support System that provides Ames-Dryden with processes to plan and control projects, integrate project manpower requirements on a directorate level, and assess the impact of proposed new projects on current commitments. The PMIS has been developed through total involvement of the organization's people. The approach was to develop processes for controlling individual projects (planning, scheduling, and tracking) and then develop processes for intra-project planning. Integrated, intra-project planning processes within all of the organizations are now successfully operative.

#### Benefits Achieved:

The objective for implementing the PMIS for planning and controlling of individual projects has been achieved. The processes identify objectives and technical requirements; create detailed work breakdown structures, schedules, and manpower plans; determine who is responsible for each aspect of the project; and provide a forum for in-depth communication. Key to the PMHS is that all personnel associated with the project are involved with the planning. This results in strong commitment to the plan. The effect of this commitment is to empower project personnel to carry out their tasks with initiative and drive. Another outcome of effective project planning is more difficult to measure, although clear from observation. Project personnel are far more likely to foresee technical problems earlier and resolve the problems more effectively, or they are more prepared to assess and recover from unforeseen problems. Immeasurable savings in time and resources are realized. However, the measurable savings are project objectives.

The major goal for using the PMIS, to integrate projects and perform intra-project planning, has been achieved. All levels and elements of the organization are involved in project planning and determining workarounds to project problems or changes in a project's scope. A measurable result is that the various decisions to resolve project problems are made more systematically, yet time to reach them is minimized. An unmeasurable result is the perception that more projects can be conducted with existing resources. Also, critical staffing categories are more accurately identified.

Contact for more information:

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805-258-3144

## 62. HAZARDOUS WASTE CONSOLIDATION, NEUTRALIZATION, AND MINIMIZATION

*Goddard Space Flight Center (GSFC)*

### Description of the Activity:

GSFC has been averaging about four tons of hazardous waste disposed per month. The hire of an Environmental Specialist in FY89 enabled GSFC to "bulk" hazardous wastes, neutralize corrosives into non-hazardous waste, and to a limited extent, find "homes" for reusable hazardous materials.

### Benefits Achieved:

The following benefits are achieved:

- (1) The ability to comply with environmental regulations relating to the storage and handling of hazardous wastes.
- (2) A \$60K to \$80K reduction in annual hazardous waste disposal costs.
- (3) A reduction in amount of hazardous waste stored in buildings resulting in a slight increase in available floor space.
- (4) The reduction of hazardous waste stored in our buildings has reduced employee exposure to these materials and has reduced building "fire loading".

Contact for more information:

Joseph Letourneau  
301-286-7444

## 63. COMMUNICATIONS LINK EXPERT ASSISTANCE RESOURCE (CLEAR)

*Goddard Space Flight Center (GSFC)*

### Description of the Activity:

The Communications Link Expert Assistance Resource is a fault-isolation expert system that is being utilized in the COsmic Background Explorer (COBE) Payload Operations Control Center (POCC) to assist the spacecraft analysts isolate and correct problems in the COBE <--> TDRS (Tracking Data and Relay Satellite) communications link.

The CLEAR Expert System monitors real-time, TDRS and spacecraft performance parameters and NCC (Network Control Center) Operations Data Messages (ODMs) in search of configuration discrepancies or communications link problems. If such a problem or discrepancy exists, this system alerts the analyst and provides advice on how to resolve the problem swiftly and effectively. And, if requested, this system will explain how it deduced the existence of the problem. This feature is essential to promote system credibility and user acceptance.

The user interface utilizes textual and graphical output on a large color monitor to provide the user with information about the status of the communications links. This is in stark contrast to the multiple screens full of textual data that are commonly used in the control center. The graphics window in the top left of the screen displays the current status of the elements of the communications network between the COBE spacecraft and the POCC. The "Problems" window displays all problems isolated by the expert system (prioritized from top to bottom according to criticality), while the "Advice" window provides the user with advice on how to correct the most critical problem or any other problem that the user selects. The analyst may also choose to display the actual telemetry parameters in the conventional display format if desired.

CLEAR is written in the "C" programming language and utilizes the "C" Language Integrated Production System (CLIPS) which was developed by NASA Johnson Space Center. The system operates on one of the seven PC/AT-type workstations that are used for real-time operations and hence, it has no effect upon the COBE POCC processing systems.

#### Benefits Achieved:

The CLEAR Expert System is the first real-time fault-isolation expert system to be used in a spacecraft control center at NASA Goddard. It is also believed to be the first real-time expert system to assist in the operation of an unmanned, earth-orbiting spacecraft for NASA. This system has proven useful to the COBE spacecraft analysts in isolating faults in the configuration and operation of the COBE <--> TDRS communications links. It has successfully alerted the analysts to misconfigurations and faults the instant that conditions indicated their existence, thus allowing the analyst to take corrective action before they worsened or created additional problems.

Contact for more information:

Peter Hughes  
301-286-3120

## 64. PERFORMANCE MEASUREMENT SYSTEM

### *Jet Propulsion Laboratory (JPL)*

#### Description of the Activity:

The Deep Space Network (DSN) Pasadena Operations Technical Support Group is tasked to accept equipment and computer program modifications as the representative of the DSN stations in Spain, Australia, and California. A primary responsibility of this group is to provide the stations with deficiency-free modifications. In January 1989, the group implemented a modified version of the Oregon Objectives Matrix as the primary tool for summarizing measurement objectives and their accomplishments.



### Benefits Achieved:

Prior to implementation of this system, approximately 50 percent of all modifications were delivered with some deficiency. Since January 1989, that number has been reduced to 10 percent. In addition, the average time for processing antenna modifications has been reduced from 14 to 7 days.

Contact for more information:

Gene Winn  
818-354-0063

## 65. USE OF AUTOMATIC NETWORK ANALYZERS FOR MICROWAVE MEASUREMENTS

*Jet Propulsion Laboratory (JPL)*

### Description of the Activity:

The increased use of automatic network analyzers has benefited work in the laboratory and, more recently, in the field.

### Benefits Achieved:

- (1) Measurement productivity has increased by an order of magnitude (both in quantity and variety of measurements). For example, many microwave components used to be assumed "good" until proven to be defective. The automatic network analyzer now permits evaluation of large numbers of components in a rapid, self-documenting manner.
- (2) Typical measurement errors have decreased by an order of magnitude.
- (3) Magnitude of errors can be easily limited to negligible levels. With previous methods, magnitude of errors was often underestimated or not understood at all due to lack of time, proper equipment, or knowledge.
- (4) Measurements over wide frequency ranges are now possible.

Contact for more information:

Samuel Petty  
818-354-5715

## 66. CULTURE SURVEY SHOWS IMPROVED EMPLOYEE PERCEPTIONS

### *Johnson Space Center (JSC)*

#### Description of the Activity:

The culture survey process at JSC is aimed at assessing the work environment to identify employee values, beliefs, and perceptions about the priorities and processes of JSC and the agency. JSC administered the second NASA Culture Survey to employees in March 1989. The 1989 Survey consisted of 154 questions, including 30 center-specific questions.

Following collection and analysis of completed 1989 surveys, focus group meetings were held for employees to discuss four specific survey topics identified by senior management for further investigation, including decision-making, cooperation/teamwork, workload management, and career development. JSC technical managers and human resources employees moderated 41 focus groups, each with approximately 10 employees. The focus group results were compiled and presented to a senior staff working group responsible for identifying appropriate actions the center will take in response to the survey. Each directorate-level organization has been providing data concerning their own unique issues, and will incorporate their actions into the centerwide initiatives.

#### Benefits Achieved:

The culture survey process will continue to be an important tool for measuring change in the JSC culture and identifying areas needing attention. It also provides a means for directly impacting the culture by providing an avenue for employee involvement and feedback. Knowledge gained from this process will help the center develop more effective ways of addressing employee needs.

Overall, the responses were more favorable in 1989. With respect to the three action areas identified in 1986, the responses for communications and role clarity were up, and the responses for career development were mixed. Responding to the area of career counseling, the center implemented a Coaching and Counseling course in 1988 for supervisors, to help them be more effective in employee counseling and development. Since its inception, approximately 50 supervisors have participated to date. The positive impact resulting from this training is expected to increase as more supervisors have the opportunity to participate.

The greatest improvement came in the area of trust within work units. Results indicate 75 percent of center employees now have a more positive view. Decision-making and information availability also received higher marks in 1989 than in 1986. Other high rated questions included four relating to quality and productivity. Those questions and the center ratings (on a 1 to 5 scale) are: JSC effectiveness is measured on how well it accomplishes its goals (4.07); NASA people value excellence (4.17); NASA people value commitment to high quality work (4.17); and, senior management emphasis is on mission accomplishment (4.39).

Contact for more information:

Diane DeTroye  
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## 67. STANDARDIZED STATISTICAL PROCESS CONTROL TECHNIQUES

*Johnson Space Center (JSC)*

### Description of the Activity:

The Quality Assurance and Engineering Division (QAED) has applied Statistical Process Control (SPC) to statistically measure the quality and productivity of various processes. SPC is a graphic tool which monitors and analyzes unnatural process variations. The process average is defined and statistical upper and lower control limits are identified based on three standard deviations. SPC is currently being used to monitor 1) flight hardware defect rates; 2) the Measurement Standards and Calibration Laboratory's (MSCL) equipment backlog and turnaround time; 3) closeouts of orbiter Corrective Action Reports (CARs); and 4) Government Furnished Equipment (GFE) discrepancy reports.

### Benefits Achieved:

SPC control charts have provided all levels of management and personnel with a common tool of communication and awareness concerning process quality. Because stable processes are predictable, SPC can be used effectively for continuous process improvement through analysis and reduction of process variation.  
Contact for more information:

Koleen Giles  
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## 68. INTEGRATED MANAGEMENT SCHEDULING SYSTEM

*Johnson Space Center (JSC)*

### Description of the Activity:

During FY89, JSC's Space Station Projects Office (SSPO) developed and implemented an integrated scheduling system used for the overall Project Office management schedule planning. Each division with the SSPO identifies, prioritizes, reports, and monitors its schedule activity and milestones which are incorporated into an integrated projects schedule. Major milestones and activities are visually represented for a three-month period on large schedule boards which are displayed in the Management Information Center (MIC). Weekly schedule status sessions involving all SSPO offices are held in the MIC to discuss schedule changes and updates.

### Benefits Achieved:

Due to the constantly evolving nature of the Space Station Freedom Program with its myriad of panels, review boards, and meetings, the IMSS (Integrated Management Scheduling System) provides the JSC Projects Manager with a top-level integrated view of project activities. This access to critical schedule information assists the Projects Manager in numerous schedule-related decisions. The system is a valuable aid to the SSPO managers in planning and staying abreast of activities across the entire project.

Contact for more information:

Amy Kennedy  
713-483-0006

## 69. COMPUTER AIDED FAULT TREE ANALYSIS (CAFTA) USED IN SAFETY ASSESSMENTS

*Kennedy Space Center (KSC)*

### Description of the Activity:

NASA KSC Safety and Reliability Engineering has procured and implemented the Computer Aided Fault Tree Analysis (CAFTA) program. A site license has been obtained which allows utilization by all contractors at KSC for commonality of system analysis.

This program enables the user to input a fault tree model (either top or component level) and receive as output a fault tree diagram and, if failure data is available, a probable risk assessment of the system. It combines design and operation into a single analysis for total safety visibility. Single failure events, multiple failure events, and critical paths to a top event can be clearly displayed. Currently CAFTA outputs are being utilized in system assurance analysis at KSC for hardware and for major operations requiring safety assessment.

### Benefits Achieved:

CAFTA enhances the safety and reliability engineer's ability to provide a top-level fault analysis in an efficient and disciplined manner. It can be used for systems and major operations using the drawing capabilities and speed of a personal computer, and it combines the safety and reliability analysis efforts.

Contact for more information:

James L. Joyner  
407-867-3555

## 70. REDUCED MODEL INSTALLATION TIME

*Langley Research Center (LaRC)*

### Description of the Activity:

A special model preparation/calibration room was fabricated to allow model build-up and calibration outside of the wind tunnel. This room contains all necessary calibration hardware, a remotely controlled leveling support system and high-pressure air system. The remotely controlled high-pressure air system was required to determine the balance tare matrix for complex propulsion integration models.

### Benefits Achieved:

Because propulsion simulation models are very complex and require many detailed calibrations, typical model build-up and calibration time is usually about one week. Previously, this activity occurred in the wind tunnel and added to the tunnel occupancy time. Based on a typical tunnel occupancy time of five weeks before the model preparation/calibration room was available, this facility will reduce tunnel occupancy time for each model by about 20 percent.

Contact for more information:

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804-864-3001

## 71. ROBOT SENSOR TEST FIXTURE FROM SALVAGED MOTION SIMULATOR

*Langley Research Center (LaRC)*

### Description of the Activity:

In 1989, a six-axis motion base which had been developed as a motion simulator for a target imaging system, but declared surplus without a control system when the project was cancelled, was refurbished for use as a testbed for multi-axis proximity sensors for robotic grippers.

Under the direction of LaRC engineers, two engineering co-op students adapted an existing stepper motor control system to provide high precision displacement under control of a personal computer, and then began a series of tests to evaluate miniature proximity sensors for control of gripper location and closure.

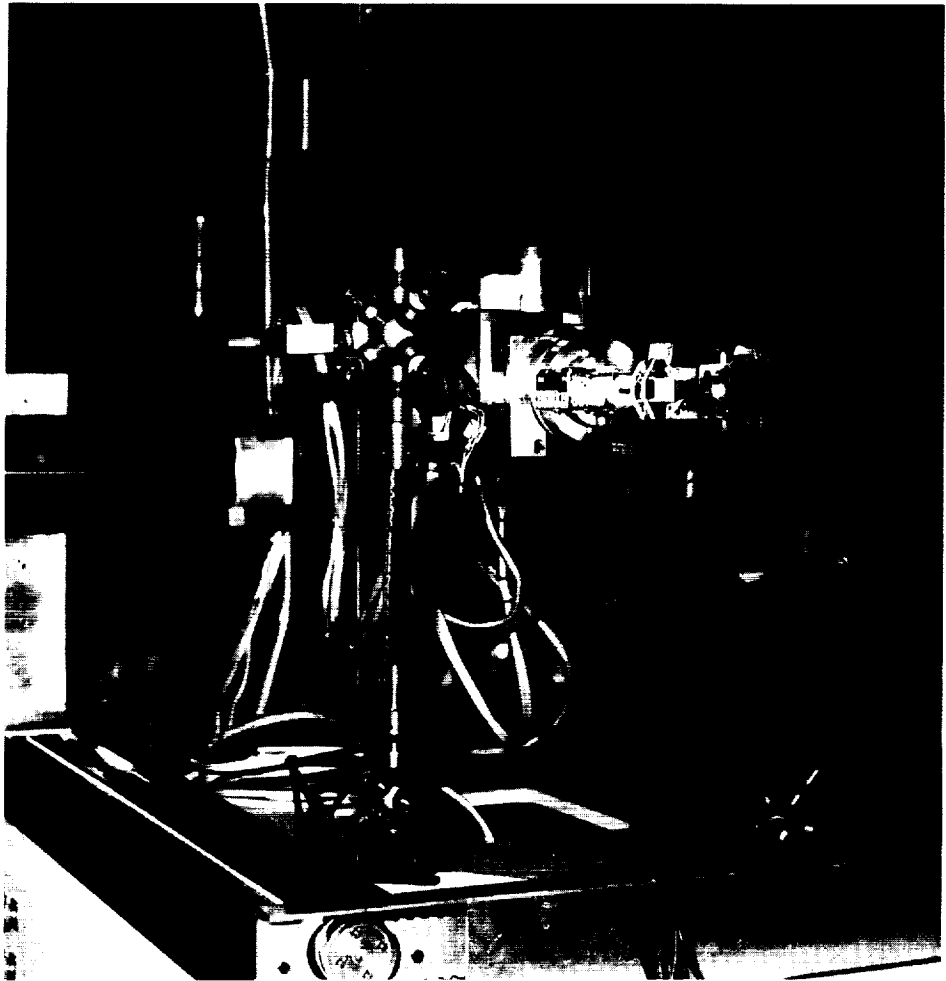
### Benefits Achieved:

Modifying the surplus motion base resulted in an estimated cost savings of between \$50K and \$75K, eliminated the need for detailed procurement specifications, and provided research results 6-12 months earlier. In addition, the engineering students gained valuable experience in servo controls, computer interfacing, sensor characteristics, and sensor-based automatic guidance.

ORIGINAL PAGE  
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Contact for more  
information:

Jack Pennington  
804-864-6677



*The modified and refurbished motion base in the multi-axis proximity sensors for robotic grippers saved between \$50K and \$70K, and the process contributed to a valuable learning experience.*

## 72. FINANCIAL MANAGEMENT SYSTEMS/AUTOMATED APPLICATIONS

*NASA Headquarters (Code EP)*

### Description of the Activity:

During 1989, the Office of Space Science Applications (OSSA) began integrating existing OSSA financial management systems and automated applications; Resources Decision Support System (RDSS), automated resources distribution system (506log). Also in 1989, the Budget Estimating Support System (BESS), Research and Analysis Tracking System (RATS), and 506log have been enhanced to provide additional data and data utilization.

The RDSS system provides real-time display of NASA financial data necessary for program management, and produces printed reports and graphics necessary for routine reviews. Prior to implementation of RDSS, data intensive and routine tasks of resources tracking were inefficient and cumbersome. Paper reports were available, but the data had to be re-entered into PCs for program analysts' use in performing various analyses, tracking resources, and producing review charts.

#### Benefits Achieved:

The automated 506log has been operational for several years, however, beginning in FY89, the system has been modified to accommodate centralized, quarterly processing of these routine documents. This has significantly reduced the number of 506Ws distributed each year, which has reduced the paperwork burden upon comptrollers office personnel both at Headquarters and field centers.

Also RDSS and 506log, prior to FY89 were separate systems working independently, but information from one system was required to be analyzed and then incorporated into the other system. During FY89 these two systems were integrated allowing for the sharing of data necessary to understand the complex financial situations and utilize this understanding to better manage resources in a timely manner.

The RATS system provides a uniform, OSSA-wide tracking and logging capability for research and analysis (R&A) activities. Specifically, this system facilitates processing of Research and Technology Operating Plan (RTOP) and Grant approvals, from initiation through actual funds distribution, and enables verification of agency financial reports against OSSA procurement activities. It provides clear traceability of procurement activity, controls funding allocations, and provides a centralized database of RTOP and Grant information. This system was enhanced to provide additional reports and information at the division and total OSSA level. The system was modified to assist in the control of planning purchase requests between OSSA and the Comptroller's Office reducing time needed to reverse any planning PRs processed out of sequence due to incomplete information being exchanged.

Contact for more information:

Scott Santiago  
202-453-1640

### 73. COST AVOIDANCE

*NASA Headquarters (Code NR)*

#### Description of the Activity:

In cooperation with the Department of Labor's Wage and Hour Division, Service Contract Act wage determinations were reviewed. The review resulted in a more timely and reflective set of NASA-wide wage rates.

#### Benefits Achieved:

The revised set of rates minimizes cost impact and avoids procurement delays.

Contact for more information:

Sam Geiser  
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#### 74. NASA TREND ANALYSIS WORKING GROUP (TAWG)

*NASA Headquarters (Code QD)*

##### Description of the Activity:

On June 1, 1989, NASA Headquarters, Data Systems/Trend Analysis Division chartered a Trend Analysis Working Group as part of the effort to develop and implement an integrated trend analysis program throughout NASA.

The TAWG's goal is to share and implement the latest trend analysis concepts, techniques, and tools. The TAWG is chaired by NASA Headquarters, Code QD, and meets quarterly. Membership includes trend analysts from each of the NASA field centers and major NASA programs. NASA contractors involved in trend analysis for NASA programs participate in a technical capacity.

The TAWG provides a means for each NASA center and program to contribute in its own way to the steady improvement of the overall NASA trend analysis program. The TAWG has four subgroups which concentrate on these four major areas of trend analysis: problem, performance, programmatic, and supportability.

##### Benefits Achieved:

The Trend Analysis Working Group has, in a short period of time, been able to help implement a solid foundational trend analysis program across the NASA community. Coordination and discussion through TAWG activities have developed and enhanced a number of trend analysis applications. The TAWG has established a practical and workable format for the development, implementation, and sharing of current trend analysis techniques and ideas which is beginning to favorably impact NASA-wide programs.

Through TAWG activities, an Orbiter problem trending effort was established at the Johnson Space Center (JSC) using procedures which were developed at the Marshall Space Flight Center (MSFC). Kennedy Space Center (KSC) applied a performance trending algorithm developed at MSFC to a mission controller screen display system. A problem trending standard for NASA-wide use was developed by MSFC. Management performance indicators for Safety, Reliability, Maintainability, and Quality Assurance (SRM&QA) have been developed by the Goddard Space Flight Center. The Space Station Freedom Program Office (SSFP) is utilizing the TAWG to review SSFP trend analysis requirements. Lewis Research Center (LeRC) has begun trending unmanned launch vehicles based on coordinated activity with TAWG members.



The TAWG further enhanced its activity by organizing a special Trend Analysis topic session to be conducted at the 36th Annual Reliability and Maintainability Symposium held in Los Angeles, CA, January 23-25, 1990.

Contact for more information:

Peter J. Rutledge  
202-453-8744

## 75. AUTOMATED RESOURCES MANAGEMENT SYSTEM ENHANCEMENTS

*NASA Headquarters (Code RB)*

### Description of the Activity:

The Office of Aeronautics and Space Technology has continued to enhance their Automated Resources System (ARS) which became operational in 1987. The system uses a relational data base, which enables multiple users to access the data base and array either tabular or graphic displays for resources management purposes.

### Benefits Achieved:

The latest enhancements, completed in 1989, provide significant data base improvements and increase user flexibility in administering a wide variety of integrated resource management reporting and control systems.

In addition, several key software improvements have facilitated the following key operational enhancements in 1989: (1) a full on-line automated budgeting capability; (2) a streamlined multi-level guidelines and resources authority control subsystem, which includes capabilities such as automated creation, modification, and printing of resources authority warrants; (3) on-line access to accounting system data; and (4) marked improvements in the amount and quality of management information being provided by all parts of the system. In addition, significant headway has been made in the implementation of an English language interface to the data base. This capability is expected to come on line in 1990.

These enhancements have reduced significantly the time required to generate these documents and reports, as well as dramatically improved the user-friendliness and flexibility associated with these integrated resources management systems.

Contact for more information:

Glen Fuller  
202-453-2790

## VII. QUALITY ASSURANCE

### 76. AUTOMATED TESTING

#### *Ames Research Center (ARC)*

##### Description of the Activity:

The overall objective of developing an Automated Test System at the NASA Ames-Dryden Flight Research Facility is to permit flight research aircraft to fly safer and with increased frequency. Automated testing promotes the rapid turnaround of changes to aircraft systems, maximizing the experiment potential in a flight test environment.

The costs associated with keeping a unique testbed on the ground are significant, and automated testing proves to be an effective tool for NASA Ames-Dryden to help reduce those costs. The first flight qualification tests for the number two X-29A aircraft in a closed loop simulation were completed in May 1989 at Ames-Dryden. The goal was to flight qualify the research aircraft subsystems in a minimal amount of time while operating in a simulated flight environment.

##### Benefits Achieved:

The automated test techniques reduced the time required to conduct the aircraft flight control system verification and validation tests from four weeks to seven days. This equates to a labor savings in excess of eight man months and allowed the aircraft to be flown three weeks earlier than would have been possible had the conventional test techniques been used.

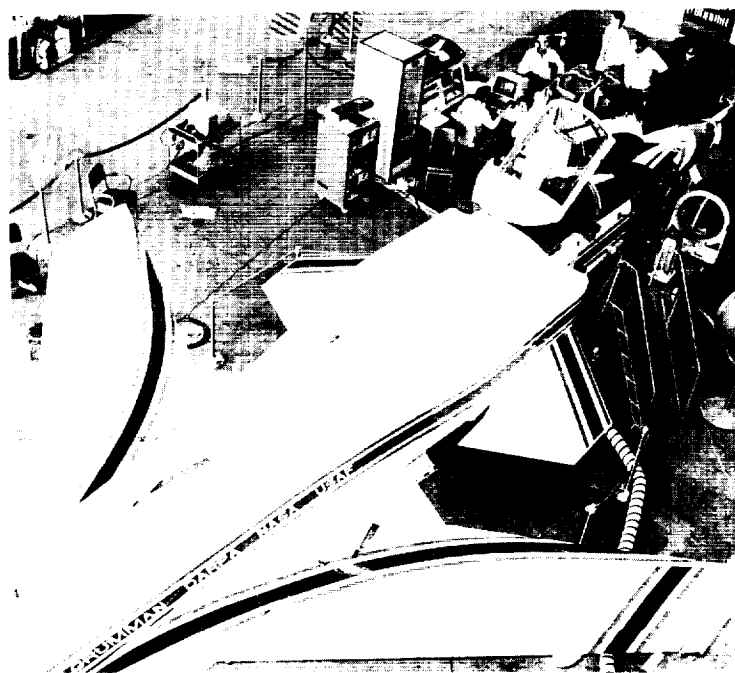
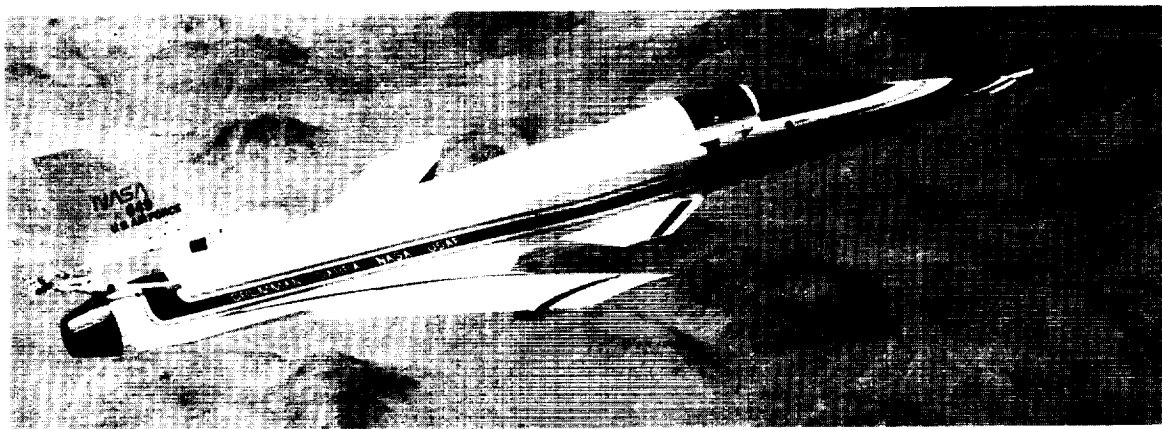
The new test techniques were used in the verification and validation testing of each flight software release. A complex digital flight control system (such as found on the X-29A) may have more than four software releases per year. The potential manpower savings for one project alone resulting from the automated testing techniques development is substantial.

The automated test process increased the number and complexity of tests that were conducted, while simultaneously reducing the time and cost of carrying out the tests. The specific developments contributing to the productivity improvement were English-like scripts that commanded the test equipment, the simulation/aircraft interface device (SID), and the signal generation capability. The English-like scripts are a means of creating test environment configuration files and test operation commands that are interpreted by a six-degree freedom simulation. The SID provides a flexible interface between the simulation computers and the aircraft. The signal generation capability allows repeatable test inputs to be summed to any control system input.

The F-18 High Angle of Attack Research Vehicle (HARV) will be the next flight research project at Dryden to utilize automated testing techniques. The change rate of the onboard research flight control computer software is expected to be high. This will enable the Ames-Dryden Flight Research Facility to take advantage of developing advanced control laws for thrust vectoring control. Automated testing will play a critical role in making this a reality.

Contact for more information:

Joel Sitz  
805-258-3666



*Automated testing at Ames-Dryden of aircraft flight control system verification and validation increases the number and complexity of tests that can be conducted, while also reducing the test time and costs.*

## 77. DIFFERENTIAL SCANNING CALORIMETRY TESTING OF TEFLON WIRE FOR EUVE PROJECT

*Goddard Space Flight Center (GSFC)*

### Description of the Activity:

The Materials Branch has supported the Extreme Ultraviolet Explorer (EUVE) Project in the differential scanning calorimetry (DSC) testing of Teflon insulated wires. The wires are tested to determine if the Teflon insulation is processed properly; improperly processed Teflon insulation can crack.

The DSC test determines if the Teflon is undersintered. So far, several wires have failed the DSC test and other qualification tests.

### Benefits Achieved:

The wires that have failed the DSC test and other qualification tests were not used in the EUVE instrument. By not using these wires, instrument failures resulting from cracking of the Teflon insulation is prevented.

Contact for more information:

James Ming and Yen Lee  
301-286-5289

## 78. INCREASED PRODUCTIVITY WITH NEW CLEAN ROOM FACILITIES

*Goddard Space Flight Center (GSFC)*

### Description of the Activity:

The need to minimize our expenditure of energy, time, and resources for in-house clean room facilities to support the assembly and alignment of optical instruments, i.e., increase our productivity, was demonstrated during the early phases of the COBE Program.

The use of portable laminar air flow units and temporary dressing rooms caused serious productivity problems in meeting the COBE contamination standards and resulted in considerable loss of time and efficiency during the assembly and alignment of the DIRBE and FIRAS. The existing class 10,000 high bay horizontal laminar flow clean facility in room 006 is well suited for large instruments such as ASTRO and SMM, but use of this facility for the smaller payloads would result in inefficient utilization of the space due to the need to limit the facility to one experiment at a time.

### Benefits Achieved:

In June 1988, a \$730,000 modification of existing space in the optical laboratories of Building 7 into two laminar flow clean rooms was initiated. The obsolete Low Temperature Optical Facility in room 004 was demolished and a 900-square-foot class 100 down flow facility was constructed. All necessary service facilities including a 'clean' crane with a 2,000-pound payload capacity are provided.

The facility will be capable of maintaining surface cleanliness levels of 300 while performing assembly and alignment activities on optical payloads with apertures as large as one meter. A 1,000-square-foot horizontal laminar facility was constructed using the room 008 optics laboratory. This design allows stringent contamination control ranging from class 100 levels near the filter wall to class 10,000 levels at the other end. The open-end access design is flexible enough to work with "dirty" handling equipment, such as forklifts, which bring heavy payloads into the facility.

The three clean rooms surround a new central machinery room which can be used to house vacuum pumping systems, experimenter support equipment, and whatever else clean room activities require. We anticipate the facilities will be finished by November this year. This MOLA experiment will move into the facility, as soon as possible, with other programs such as MODIS-T, XTE, GRID, and CASSINI-CIRS to follow later. The high bay clean room will then be available for LITE, HRS, EUVE, LYMAN/FUSE, ST instrument quarter panel, and other large instrument payloads.

Converting inefficient and obsolete building space into new laboratories greatly increases our productivity and significantly increases the quality of our work. The laboratories are designed to expedite the work flow and increase the number of payloads that can be accommodated at any one time.

Contact for more information:

Richard Harner  
301-286-8131

## 79. ELECTRON MICROSCOPY UPGRADE

*Jet Propulsion Laboratory (JPL)*

### Description of the Activity:

A state-of-the-art digital electron microscope and image enhancement/analysis system has been installed in the Section 355 Materials Laboratory.

### Benefits Achieved:

This instrument provides the capability to more rapidly analyze materials to achieve needed quality control for both metallics and composites for spacecraft. The facility has been utilized to assure proper processing of composites producing fiber uniformly, void content control. Analyses of metallics, including thin films for capacitors and integrated circuits, have been evaluated to identify process problems and solutions. Fasteners have been evaluated via fracture surface examination to shorten fastener certification time.

Contact for more information:

Wayne Phillips  
818-354-4051

## 80. SPATIAL PLANNER APPLICATION

*Jet Propulsion Laboratory (JPL)*

### Description of the Activity:

The spatial planner, originally developed for the telerobot testbed, was implemented as part of the JPL/KSC Inspection Demonstration in November 1989. The spatial planner generates gross-motion collision-free paths between a current robot manipulator position and a desired position.

The inspection system involves an ASEA IRB-90 manipulator, with a camera attached to the end-effector, used to inspect a PAM-D motor and cradle. Three inspection points were tested in a constrained workspace. The spatial planner found collision-free paths to move the ASEA's end-effector to the desired inspection points, with each path generation taking less than 30 seconds. A significant achievement was that the spatial planner was safely used with real flight hardware.

### Benefits Achieved:

- (1) The automated path planning simplifies the inspection system's tele-operated tasks which are tedious and difficult in a constrained workspace. The system also eliminates the need for humans to perform complex tasks which are hazardous to equipment.
- (2) It may be applicable to planetary spacecraft platforms.

Contact for more information:

Jacquelyn O'Meara or Carol Collins  
818-354-1127                      818-354-0157

## 81. TESTING OF SPACECRAFT RESILIENCE TO ORBITAL DEBRIS

*Johnson Space Center (JSC)*

### Description of the Activity:

The Hypervelocity Impact Research Laboratory (HIRL) provides the capability (within the state of the art) to simulate meteoroid/debris impacts on spacecraft materials and provides the means for: (a) researching new low-weight shielding concepts; (b) evaluating spacecraft survivability, primarily Space Station Freedom; and, (c) testing the effects of hypervelocity impact on new materials. The laboratory has achieved the capability to launch the largest range of projectile sizes in any one laboratory in the country: specifically, 100 microns to 1.27 cm at hypervelocity.

The most recent addition to the HIRL is a renovated .50 caliber light-gas gun used for projectile launching. This gun, developed two years ago for other research purposes by Ames Research Center, was not being utilized. Since it had potential for space debris research, JSC arranged to borrow it from Ames, thus saving NASA at least \$250,000 by not purchasing a new gun. The gun, affectionately known as "Old Blue," is one of the highest performing guns ever built.

### Benefits Achieved:

The capability to launch the large range of projectile sizes has resulted in a number of breakthroughs in shielding research for Space Station Freedom (SSF). Shielding research supported by the HIRL has resulted in a number of new light-weight shielding concepts which will support SSF and result in significant weight savings and an increased crew safety margin for long-duration spacecraft. The laboratory has been developed with minimal funding and is very cost-effective (comparable testing at non-NASA facilities would have been prohibitive). In addition to supporting the JSC hypervelocity impact program, the HIRL has supported other NASA centers and government agencies.

Contact for more information:

Jeanne Crews  
713-483-5308

## 82. NATIONAL SPACE TRANSPORTATION SYSTEM (NSTS) TOOL CONTROL PROGRAM AT KSC

*Kennedy Space Center (KSC)*

### Description of the Activity:

Kennedy Management Initiative (KMI) 5330.8 established the KSC policy that a formal tool control program and operational standards be established and maintained for effective control of tools/tool kits used in association with Space Transportation System (STS) Flight/Ground Support Equipment (GSE) processing activities.

The program was placed into effect with the delivery of the first tool boxes to the Orbiter Processing Facility (OPF) High Bay 2 on November 30, 1989. Tool boxes are scheduled to be distributed to other operational areas by February 8, 1990.

Benefits Achieved:

The Tool Control Program intends to preclude the loss of or damage to flight hardware, or injury to a flight crew by providing 100 percent inventory of the tools at the beginning and end of each shift under the surveillance of the supervisor and Quality Control. This inventory will ensure that tools are not inadvertently "lost" while work is being performed on flight hardware.

Contact for more information:

Raul Reyes  
407-867-3392

ORIGINAL PAGE  
BLACK AND WHITE PHOTOGRAPH



*Astronauts visiting KSC's Orbiter Processing Facility inspect the first set of tools in the newly designed tool box that allows a quick check for missing or misplaced tools. The debris control program at KSC requires that all tools be accounted for to preclude damage to flight hardware or injury to flight crew when the orbiter reaches zero-gravity in space.*



### 83. NEW QUALITY SURVEILLANCE RECORD FORM USED

*Kennedy Space Center (KSC)*

#### Description of the Activity:

In August 1989 a newly designated and adopted Quality Surveillance Record (QSR) form was used for the first time. This form was used by all Quality Assurance Specialists to document surveillance and verification actions of contractor work performance, and became the basis for our NASA Quality Assurance Reporting System.

#### Benefits Achieved:

This QSR has three distinct advantages over the previous reporting system. It (1) allows multiple surveillance and verification entries on a single form; (2) incorporates a coding system which specifically identifies problems; and (3) increases viability of data entered into a data base than the previous system.

Multiple entry capability has resulted in tremendous monetary savings and saved an estimated 290+ man days a year in documentation savings.

Contact for more information:

Terry Smith  
407-867-6062

### 84. SEMINAR SPONSORED BY THE HAMPTON ROADS TQM FORUM

*Langley Research Center (LaRC)*

#### Description of the Activity:

In conjunction with National Quality Month, private sector and government organizations in the Tidewater, VA, area planned and conducted a Total Quality Management (TQM) seminar. Major organizations such as the Norfolk Naval Shipyard, Canon of Virginia, Tenneco, the Office of Management and Budget (OMB), and NASA were involved. Langley's Quality Assurance Head served as a panel presenter and shared his activities with the attendees. Langley's Productivity Focal Point also served as a panel moderator.

#### Benefits Achieved:

An overview of the status of various TQM activities underway in this area was presented. Lessons learned and future plans were provided and has helped generate a network of key contacts in the various organizations represented.

Contact for more information:

Walter G. Hoggard  
804-864-3361

## 85. SAFETY AND QUALITY ASSURANCE PROCESS IMPROVEMENTS

*Lewis Research Center (LeRC)*

### Description of the Activity:

To support Lewis' commitment to in-house design and development of STS flight experiments, the Office of Mission Safety and Assurance undertook a diversified, multi-disciplinary initiative to assure a credible QA program. This initiative included: 1) Quality, Safety and Material Engineering support to designers with sign-off on critical parts and materials and phased safety submissions; 2) certification of technicians in soldering and assembly techniques; 3) development of a fabrication quality system including nonconforming material bonded storage and process routing/control; 4) critical process documentation; and 5) closed-loop nonconformance (discrepancy, problem and failure) reporting.

A simplified safety and environmental hazard reporting system has been established, utilizing a "Safety Help Line" which can be called by any center individual to report actual or potential hazards, assuring proper notification and timely, effective action. This system supplements, rather than replaces, the standard safety reporting system. Inputs to the system are electronically logged and result in generation and prioritization of appropriate work orders. Adequate close-out is assured by tracking and responding to the individual originally making the report.

### Benefits Achieved:

The QA program for in-house design and development of STS flight experiments has improved coordination among design, fabrication, assembly, test and quality groups. It is a simple, controlled, well documented system which satisfies the rigorous NSTS space flight requirements and assists the experimental projects in meeting their mission requirements.

The Safety Help Line encourages the reporting of unsafe conditions by relieving the individual of the associated paperwork burden and potential organizational conflicts. The system has enhanced the center's risk management capability; processing and response time for safety-related work orders has been reduced by more than 50 percent, significantly reducing the potential for injuries.

Contact for more information:

Frank Greco  
216-433-2650

## 86. LIMITED LIFE COMPUTER MODEL

*Marshall Space Flight Center (MSFC)*

### Description of the Activity:

It is critical that a timely assessment be made of items approaching the end of their certified usage life to allow for their replacement or recertification. In the past, hardware data supporting this assessment was obtained by a time consuming manual process prior to each flight. In an effort to streamline this process, computer models were developed to identify, track, and provide prediction capabilities for limited life hardware items used in NASA space flight programs. This limited life tracking computer model has the capability to track all age, time, and cycle sensitive items and provide warning for items that have approached, or are approaching, their limited life. In addition, a reliability/statistical computer model has been developed that can determine the risk of extending the limited life of items.

The user can select from a menu that includes all age expiring items, all time expiring items, all cycle expiring items, all items in the data base, and any combination of the above. Thus, the user can call up the shelf life, age, and/or cycle expiring items for each element of the limited life item data base.

### Benefits Achieved:

These two computer models provide a real-time status of limited life items and data allowing for timely corrective action, avoiding reliability and schedule impacts. The models allow for significant savings in man-hours for statusing limited life items and can be used by contractors and other programs.

Contact for more information:

J. H. JOHNS  
205-544-2323

## 87. PROPERTY/SUPPLY CONTROL

*NASA Headquarters (Code DBE)*

### Description of the Activity:

Duties in the Logistics Management Branch have been re-aligned to create a review and control point for all incoming purchase requests and to eliminate non-purchasing activities from the Small Purchase Unit.

Benefits Achieved:

By creating one single control point, all purchase requests can be reviewed for consistency and adherence to policy, and analyzed for the most cost efficient pricing. In addition, this up-front research helps expedite the Small Purchase process so buys can be made more quickly.

Contact for more information:

Christine Williams  
202-453-1810

88. ENHANCED CENTER MANAGEMENT APPROVAL AUTHORITIES FOR PROCUREMENT ACTIONS

*NASA Headquarters (Code HS)*

Description of the Activity:

Master buy plan procedures focus headquarters management attention on significant dollar value and other sensitive procurements while maintaining Headquarters' control over essential management functions.

Approval of incremental funding of contracts not meeting specific conditions required Headquarters approval. Major procurements must follow formal source evaluation procedures to assure compliance with procurement statute and regulation. All of these activities require substantial participation from center and Headquarters program/procurement/resource personnel and considerable time to accomplish.

Benefits Achieved:

By increasing master buy plan thresholds, the centers will be able to implement more procurements within their own management review process, which should improve their productivity while maintaining Headquarters visibility into the quality and effectiveness of major NASA acquisitions.

Delegating approval of incremental funding actions to center procurement offices will reduce administrative burdens on Headquarters and center technical, procurement, and legal offices, reduce paperwork, and decrease acquisition leadtimes for these procurements. By raising the threshold for formal SEB procedures, streamlined acquisition/source evaluation procedures can be applied to more procurements, thereby saving significant technical and procurement resources in conducting more modest procurements and allowing Headquarters and center management to better focus limited personnel resources on the more complex and critical acquisitions.

Annual MBP actions reviewed at Headquarters have been reduced by one half, or 35 actions. SEBs reviewed at Headquarters have been reduced by about 10. About 30 incremental funding actions are no longer processed at Headquarters each year resulting in an estimated annual savings of 1,460 days in document processing time. Additionally, the number of center personnel assigned to source selections is reduced on average from about 60 to 10 when the formal SEB process is not used.

Contact for more information:

Jack Horvath  
202-453-2080

# NASA/CONTRACTOR TQM INITIATIVES

## I. TOP MANAGEMENT LEADERSHIP AND SUPPORT

### 89. EG&G FLORIDA QUALITY COUNCIL

*Kennedy Space Center (KSC)*

#### Description of the Activity:

The EG&G Florida Quality Council, composed of senior managers, has assumed responsibility for leading the Total Quality Management (TQM) implementation effort. The mission of the Quality Council is to guide and drive the TQM process throughout EG&G Florida by providing the leadership to ensure continuous improvement of products and services. In addition, each senior manager heads his or her own organization's Quality Council to ensure the successful rollout of TQM in all parts of the company.

The Quality Council was formed to take a closer look at the issues that affect our ability to work together toward the common goal of total quality management. The Quality Council provides direction for TQM planning and a quality improvement process that will reach every EG&G Florida employee. Understanding that making TQM happen is not a simple matter, each senior manager will champion this process in his or her organization.

#### Benefits Achieved:

The Quality Council provides the forum for senior management to gain a better understanding of TQM principles and concepts. It also provides the forum for addressing how we will effectively integrate TQM with our existing processes and what new initiatives are necessary to implement TQM. The Quality Council also serves to demonstrate to the work force that EG&G Florida is very serious about TQM.

Contact for more information:

James R. Dubay (EG&G Florida, Inc.)  
407-867-7295

## II. FOCUS ON CUSTOMER

### 90. MISSION CONTROL REAL-TIME DATA INTERFACE SYSTEMS

#### *Johnson Space Center (JSC)*

##### Description of the Activity:

The JSC Systems Development Division, along with IBM and Lockheed, have recently implemented two important activities which greatly improve the quality of information available to flight controllers and engineers during actual missions:

1. The Distributed Earth Model Orbiter Simulation (DEMOS) system is a 3-dimensional visualization application which provides flight controllers with a realistic representation of the orbiter's position in relation to the Earth, Sun, Moon, stars, and satellites. Guided by requirements from flight controllers, the 3-dimensional scene can be viewed from different perspectives, including on-board shuttle cameras, windows, and synthetic eyes around the orbiter and Earth. Five key technological systems used at MCC (Mission Control) workstations have been combined into one system for visualizing orbiting spacecraft, including: astrodynamics; 3-D graphics standard; real-time data acquisition; distributed processing; and graphical user interfaces.
2. The Universal Gateway is a closed-loop information exchange, whereby orbiter data is translated during the mission to language understood by the engineering community in real-time. The process provides a controlled, electronic interface to the Near Real-Time Telemetry (NRT) database for authorized end users on the JSC Engineering and Science Network (JESNET). Users build and submit data requests through software (developed by the Avionics Systems Division and Lockheed) running on a special node on the JESNET. The Universal Gateway receives the requests and transfers them to NRT. The requests are processed by NRT and the data is sent to the Universal Gateway, which ships it back to the JESNET.

##### Benefits Achieved:

1. By combining these complex information systems into the unified DEMOS system, the mechanism provides a greatly enhanced visible perspective of the shuttle and its surroundings previously unavailable from live video only. By employing 3-D graphics for scene generation, flight controllers are provided with realistic visual information which augments textual information obtained from console displays. Specifically, DEMOS will be employed in attitude and pointing tasks of the orbiter's position during training, pre-mission analysis, and on-orbit monitoring. By complementing flight data with video enhancements, the tool will minimize the time required for both pre-mission analysis and project support.

In addition, DEMOS provides a working system which employs key workstation technologies important to numerous Mission Control systems. The knowledge acquired through the DEMOS system will also directly benefit the adaptability and re-use of software components and techniques utilized in these individual applications.

2. The Universal Gateway allows engineers timely access to orbiter data contained in the NRT data base. Previously, data requests were made via batch processing and responses were received the next day. During missions supported by the Universal Gateway (STS-29, STS-30, and STS-34), response times have averaged between three and five minutes. This immediate access will broaden and enhance the knowledge base of engineers on shuttle systems performance, thus improving the quality of the engineering process, and resulting in increased productivity, effectiveness, and safety.

Contact for more information:

Erik Geisler  
713-483-0927

#### 91. ENHANCED METHOD FOR PAYLOAD INTEGRATION

*Johnson Space Center (JSC)*

##### Description of the Activity:

GE Government Services has developed new technology for use by payload integrators for Spacelab experiments, and eventually for Space Station Freedom (SSF) scientific payloads. The process promotes rapid and simple installation and removal of rack-mounted equipment, as well as standardization of experiment-to-rack interfaces. The mechanism and process incorporates commercial standard interface circuits, hardware, and design techniques to accommodate experiment module-to-rack installation and mounting without tools or reconfiguration of experiment hardware or software.

Using a standardized set of interfaces, blind mating or demating of connectors takes place when experiment hardware is inserted into or removed from a rack along the rack-mounted slide guiders. The mechanism and concept are utilized in the SLS-2 Mission (Skylab) and are presently contemplated for use in the IML-3 and D-3 missions.

##### Benefits Achieved:

The new mechanism and process requires less man hours for payload integration, allows on-orbit replacement of experiment modules, simplifies management of multiple experiments in the same rack, accommodates processing of small and rapid response payloads, and provides a mechanism for the interchangeability of experiment equipment between Spacelab and SSF racks. The concept simplifies and lowers costs for experiment design, analytical and physical integration, and facilitates both interface verification and on-orbit servicing.



Contact for more information:

R. Parker  
713-280-2706

## 92. IMPROVEMENT INDICATOR WORKSHOP

*Kennedy Space Center (KSC)*

### Description of the Activity:

EG&G Florida employees are involved in Improvement Indicator Workshops. The objective of the workshop is to focus natural work groups on developing improvement goals based on customer needs and expectations. The workshop was developed to help the work groups accomplish this objective using a simple, organized approach. The approach involves work groups going through four basic steps (1) identifying its inputs, outputs, suppliers, and customers; (2) meeting with or using a survey tool to communicate with the work group's suppliers and customers to clearly identify requirements and expectations; (3) identifying gaps or deficiencies in meeting requirements and expectations; (4) developing improvement goals to correct the deficiencies, and finally, (5) developing improvement indicators (measures) that track the progress of the group's performance relative to meeting the deficiencies as noted by the customer(s). The key to the success of the workshop is getting the work groups involved in developing indicators that focus on meeting the requirements and expectations of the customers, rather than on individual performance.

### Benefits Achieved:

The workshop provides EG&G Florida the opportunity to focus on many Total Quality Management (TQM) principles. It provides a forum for promoting work force involvement in improving the quality of products and services. It opens communications between suppliers and customers, therefore, relationships are strengthened. The workshop promotes a "customer orientation" and focuses improvement efforts on meeting customer requirements and expectations. Last, but not least, it promotes employee involvement in developing indicators and measures which eliminates some of the resistance normally experienced in developing performance measures.

Contact for more information:

Thomas R. Tubbs  
407-867-2300

### 93. ADVANCED X-RAY ASTROPHYSICS FACILITY (AXAF)

*Marshall Space Flight Center (MSFC)*

#### Description of the Activity:

In the development of the 12 cylindrical mirror elements for the AXAF X-Ray High Resolution Mirror Assembly, the mirror blanks are fabricated by Schott and supplied to Hughes Danbury Optical Systems who fabricates the finished mirror elements under subcontract to TRW. The major phases of the fabrication process included blank generation, fine grinding, and figure correction/polishing. The mirror blanks, as originally ordered from Schott, provided one millimeter of material on the inner surface to be removed by processing at Hughes. The majority (90%) of this surplus material was to be removed by using the large optics grinder with a fixed diamond wheel prior to the loose abrasive grinding phase. However, due to difficulties in developing the Inside Diameter Generation Machine (IDGM), this equipment was deleted and the already available Automatic Cylindrical Grinder (ACG) was used to perform the generation process and prepare the mirror for the polishing phase.

Recognizing the potential for increased schedule requirements inherent in using the loose abrasive grinding process for the removal of a relatively large amount of surplus material, and the fact that the glass blanks being provided had excellent dimensional tolerance control and low subsurface damage, it was recommended that the AXAF project consider the feasibility of removing more of the glass on the inner surface for the purpose of reducing the overall fabrication time. Discussions with Schott determined that they were willing to remove an additional 0.75 mm from the inner surface, leaving only 0.25 mm to be removed in the finishing process. This change was approved and the revised mirror blank dimensional requirements are being implemented.

#### Benefits Achieved:

An in-depth study on the newly approved approach determined that the additional effort will not affect the optics program critical path schedule; the estimated time savings will be about 25 weeks, and the net dollar saving to the overall optics program will be about \$2.8 million.

Contact for more information:

Fred S. Wojtalik  
205-544-0647

#### 94. CUSTOMER FOCUS WORKSHOP

*Marshall Space Flight Center (MSFC)*

##### Description of the Activity:

In 1989, in conjunction with the United Technologies Corporation's customer focus workshop, USBI and members of the MSFC Solid Rocket Booster Project Office, were provided a unique opportunity to jointly generate ideas and plans for improving customer focus. The two-and-one-half day workshop, attended by key USBI and MSFC managers, taught the concepts of a customer focused organization. Workshop sessions enabled class members to apply the concepts to a previously identified issue. Classroom discussion and guided application reinforced the concepts and techniques. The course allowed for an exchange of information and showed how the skills learned could be applied to jointly develop an action plan to get in touch with your customer, break down barriers, and build a customer focused organization.

##### Benefits Achieved:

These sessions stressed the need to make sure that customer requirements are understood and satisfied, and that the quality of the product and services provided are improved. Specific benefits included a better understanding about customer focus; what it is, why it's important, and how to increase it. Methods were provided for forging closer relationships with key customers, working toward resolution of important customer focus issues, improving critical skills and processes, building relationships with others, and sustaining the leadership and quality initiatives developed.

Contact for more information:

Al Blanks  
205-721-2462

#### 95. IMPROVEMENTS IN SOLID ROCKET BOOSTER FASTENER COVERAGE

*Marshall Space Flight Center (MSFC)*

##### Description of the Activity:

In a continuing effort to simplify closeout operations while gaining advantages for Solid Rocket Booster (SRB) flight, the NASA/USBI team shortened the lengthy process by which thousands of exterior bolthead fasteners have been sealed against water intrusion. After accomplishing the March 1989 maiden flight for Marshall's modified spray ablator (MSA-2), NASA USBI carried out a laboratory study confirming the ablator's superb adhesion to the sealant used along the fastener rows.

The subsequent first step toward altering the processes for this specialized region was the removal of thousands of sealant caps after sealant application. Serving foremost as "measuring cups" for each plug of bolthead sealant, the retention of these caps during SRB flight has meant multiple steps in order to prepare their rubbery surfaces for a hand-troweled topcoat. Both the cap and its troweled topcoat were proven less effective than the new one-step MSA-2 spray coverage over the bare, uncapped sealant plug.

Benefits Achieved:

The bare-sealant (no cap) method reduces the risk of debris impact on Orbiter tiles due to improved adhesion between ablator and sealant. Its implementation on the frustum and aft skirt segments alone also means an estimated savings of \$19,600 per flight set, derived from the avoidance of time-consuming preparatory steps incurred by insulating the nonfunctional cap: specifically, cap deglossing, solvent wiping, priming, painting, thermal protection system troweling, and masking off from the final thermal protection system spray of adjacent areas. Labor savings per flight set are estimated at 463 man hours.

Contact for more information:

Carl Lester  
205-544-4804

96. MODERNIZATION OF DIGITIZING/GRAPHICS SYSTEM

*Stennis Space Center (SSC)*

Description of the Activity:

The equipment used to support the Department of the Navy's Bathymetry Chart Digitizing Program was outdated and required excessive maintenance. This project involved analyzing needs, and justifying and recommending procurement of new equipment for the program.

Benefits Achieved:

The procurement and installation of the new equipment has increased productivity by approximately 30 percent. This project has resulted in a \$47,682 annual cost savings in labor and maintenance.

Contact for more information:

George B. Nelson (Sverdrup Technology Inc.)  
601-688-1336

### III. EMPLOYEE EMPOWERMENT AND TEAMWORK

#### 97. BLAST AND RECOVERY TYPE SYSTEM USED IN PAINTING OF 16-FOOT TRANSONIC TUNNEL WORK CONDUCTED BY NASA SUPPORT CONTRACTOR EG&G

*Langley Research Center (LaRC)*

##### Description of the Activity:

During the maintenance shutdown of the 16-Foot Transonic Tunnel, the deteriorated lead-based paint was removed from the interior of the tunnel circuit and an approved finished coating was applied. Since the lead content was classified as a hazardous waste, the waste material had to be handled, stored, transported, and disposed of in accordance with EPA and federal guidelines. Because of this it was essential to engineer and develop a plan to meet stringent schedules and guidelines. A blast and recovery type system was used which separated the hazardous paint debris from the steel grit abrasive. During the blasting process, spent abrasive and debris was recovered by a vacuum hose and transported back to the separator/hopper mounted over the blast machine. The re-usable grit was then separated from the debris and grit fines and deposited in the storage portion of the hopper. The larger pieces of lead paint chips and grit fines were then stored in approved 55-gallon drums.

##### Benefits Achieved:

The steel grit was re-used several hundred times, drastically reducing the tons of abrasive needed to complete the task. The number of barrels of hazardous waste was also reduced because it was separated from the spent abrasive. By using this system, labor man-hour cost was also reduced since it was not necessary to handle the tons of spent abrasive which would have been created if using conventional silica sand. The following savings were realized by using the new system:

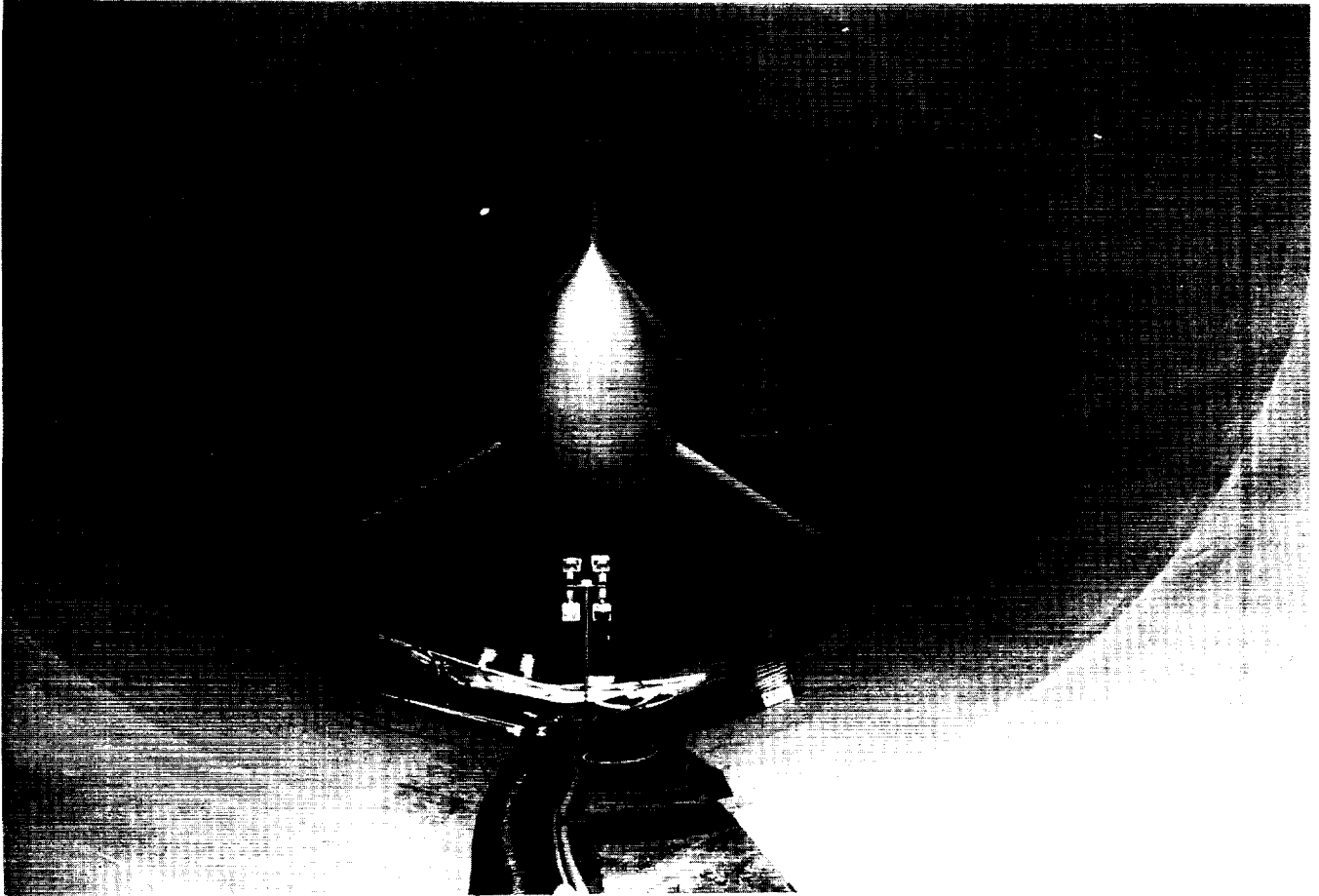
\$134,870 - abrasive material
\$262,920 - cost of drums
<u>\$1,690,200 - disposal savings</u>
\$2,087,990 - Total Savings

This project activity demonstrated excellent teamwork of contract partner and center employees.

Contact for more information:

June Howell  
804-864-2663

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*An efficient blast and recovery type system was used to remove lead-based paint from the interior of the 16-foot Transonic Tunnel. The system allowed for re-use of the abrasive, safe handling of the hazardous paint debris, and more than \$2 million in cost savings.*

98. LEWIS/CONTRACTOR TEAM WINS R&D-100 AWARDS

*Lewis Research Center (LeRC)*

Description of the Activity:

Lewis researchers won three more Research and Development 100 (R&D-100) Awards in 1989, given by R&D Magazine, for the most outstanding new technological developments in the world. Lewis now ranks fifth on the list of all-time winners worldwide. Lewis' three award winning projects are described below.

- 1) A joint venture between Lewis, Analex, and Varian Associates resulted in the development of the Varian Associates Model VKP-7990. The entry is a multistage depressed collector klystron amplifier intended for use in UHF television transmitters.

- 2) An optical component called the Gigabit Monolithic Optical Integrated Receiver was developed as a joint effort between Lewis and Honeywell. The technology can be used in any system in which high-speed digital data must be transmitted from point-to-point in a serial format and then used in a parallel or decoded format at the destination. Examples of the applications include transmission and decoding of control information to phase shifters in phased array antennas for communications and radar applications, and high-speed, short-haul data communications between computers and peripherals and in local area networks. It also has applications in consumer electronics.
- 3) A two-step procedure for recording and analyzing pulsed laser velocimetry photographs, called the Vector Scanning Data Reduction Technique for Pulsed Laser Velocimetry Data, was developed at Lewis. The technique is used for non-intrusively measuring airflow during research.

#### Benefits Achieved:

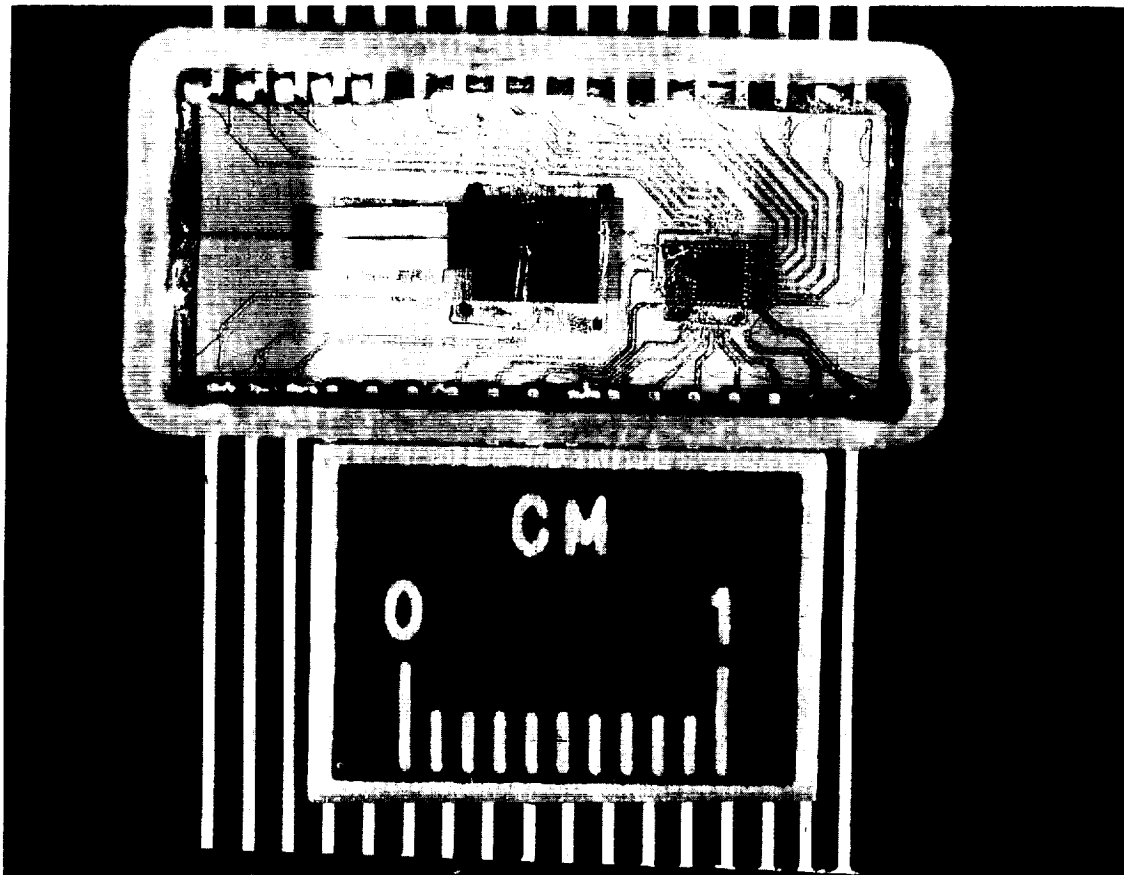
The VKP-7990 technology cuts UHF transmitter electrical power consumption by half, leading to annual savings of more than 400,000 kilowatt hours. More than 1,000 transmitters are currently in operation that could benefit from this technology. Other potential applications include microwave communications systems, radar systems, microwave heating systems, and particle beam accelerators.

Benefits of the Gigabit Monolithic Optical Integrated Receiver are a five-fold reduction in size, a 2.5-fold weight reduction, and a 10-fold reduction in power consumption versus existing products.

The Vector Scanning Data Reduction Technique overall system cost is about one-fifth the cost of existing systems, and processes recorded data two orders of magnitude faster than current techniques.

Contact for more information:

Anthony Ratajczak  
216-433-2225



*The gigabit monolithic optical integrated receiver, developed by NASA Lewis Research Center and Honeywell, provides not only the advantages of optical data communication, but also size, weight, power and speed advantages over conventional optical receivers.*

#### 99. MSFC/CONTRACTOR QUALITY AND PRODUCTIVITY PARTNERSHIP

##### *Marshall Space Flight Center (MSFC)*

##### Description of the Activity:

Based on the work of the ad hoc group established at the Second MSFC/Contractor Workshop held in February 1989, the MSFC/Contractor Quality and Productivity Partnership was formalized at a meeting held on May 25-26. At that meeting, the newly formed Partnership adopted the following vision and mission statements.

**VISION STATEMENT:** To be recognized as the champion of the continuous pursuit of excellence in productivity and quality and to be unsurpassed as the model for all government/contractor partnerships.

**MISSION STATEMENT:** The MSFC/Contractor Quality and Productivity Partnership is established to facilitate and act as a catalyst for continuous improvement among MSFC, its contractors and subcontractors. This partnership creates a culture and an environment which fosters information exchange and cooperation leading to quality and productivity improvements among and within member organizations.



Also adopted were a set of organizational guidelines that assure the continuity necessary for the smooth operation of the Partnership and the flexibility necessary to adjust to changing conditions and changing membership.

The Partnership established five working teams - The Planning Team, The Communications Team, The Educational Opportunities Team, The Contracts Team, and the Top Management Commitment Team to guide the Partnership and to study and resolve issues of general concern. On June 14, The MSFC Productivity Steering Council endorsed the Partnership's vision and mission and, thereby, provided official recognition of its activities.

Subsequent meetings of the Partnership in August and November, hosted by the Boeing Company and the MSFC SRM&QA Office, respectively, featured the sharing of ideas, discussion of common concerns, and the study of issues of mutual interest. Also featured at these meetings were progress reports from each of the working teams.

#### Benefits Achieved:

The Partnership has provided excellent opportunities for sharing information on the various continuous improvement programs in place across the aerospace community. It has provided a network of support for those persons charged with these programs in the organizations represented. The MSFC organizations and 30 contractors who currently participate in the Partnership have raised important issues of mutual concern and are in the process of examining solutions for presentation.

Contact for more information:

Larry Lechner  
205-544-5227

## IV. MEASUREMENT AND ANALYSIS

### 100. "FLY-THROUGH" SOFTWARE

*Goddard Space Flight Center (GSFC)*

#### Description of the Activity:

Software that allows a researcher to define a flight path and "fly through" a sequence of 3-dimensional perspective views of a surface rendered from data values has been written by Ronald Klasky (STX/635) and David Pape/635 for the Silicon Graphics personal IRIS workstation.

This software consists of three programs. The first allows interactive viewing, from any point of view, of a wire frame version of an elevation surface prepared from the data values. Scientists can use this program to find interesting and useful views and viewpoints.

The second allows the interactive selection of a flight path over the surface. The flight path together with a gray level view of the surface and the corresponding elevation function are input into the third program which generates a sequence of 3-dimensional perspective views of the surface. The views are computed based on the position and direction along the flight path. The resolution of the computed views can be controlled. Low resolution views can be computed and viewed interactively so that any needed modifications to the flight path can be quickly determined. High resolution views up to 512x512 pixels can be computed, but at a slower rate, and stored in sequence on an optical video disk which then allows viewing at rates up to 30 images per second.

#### Benefits Achieved:

The "Fly-by" software permits the use of motion in image data set analysis for detecting features that may not be observed by analyzing images individually.

Contact for more information:

Dr. James Strong  
301-286-9535

## 101. SUCCESS FACTORS FOR ENGINEERING ORGANIZATIONS STUDIED AT LEWIS

*Lewis Research Center (LeRC)*

### Description of the Activity:

A study by The Center for Management of Science and Technology (CMOST) involved the Lewis Engineering Directorate and three architect/engineering firms in an attempt to identify critical success factors for high quality projects in an engineering environment. (The private firms included R. E. Warner and the Osborn Company which, in addition to other work, make up part of the Lewis architect and engineering contract team of Warner/Osborn/ Pardee). The difficulty lay in identifying these factors in an environment where the product is different on every job, and creativity and judgment are of great importance.

CMOST identified a number of factors which, if successfully implemented, ensure overall success in producing high quality work and meeting customer expectations. Specific recommendations were shared with each organization participating in the study.

### Benefits Achieved:

Through analyzing performance on the critical success factors, organizations can work to ensure high quality and satisfied customers. Parameters include up-front clarity about project requirements, integration of specialized disciplinary expertise for the project, systems to address the variation in quality between projects, systems for identifying and sharing lessons learned, and others. Study participants can use the specific recommendations to focus efforts within their own organizations.

Contact for more information:

Joseph Yuska  
216-433-3830

## 102. INSTALLATION OF A HYDROGEN PURIFIER IN THE GAS AND MATERIALS ANALYSIS LABORATORY AT SSC

*Stennis Space Center (SSC)*

### Description of the Activity:

At Stennis Space Center, the Gas and Material Analysis Laboratory (G&MAL) requires high-purity hydrogen for proper and consistent operation of several analytical instruments including the gas chromatographs and flame ionization detectors. In the past, research grade hydrogen, purchased in K-bottles, was used for this purpose. In addition to the expense of the high-purity hydrogen, changing out the K-bottles involved instrument down-time and many man hours.

To alleviate these problems, a new method was instituted which involved coupling a hydrogen generator to a hydrogen purifier equipped with a palladium catalytic unit.

Benefits Achieved:

This method generates the necessary amounts of purified hydrogen from de-ionized water and greatly reduces instrument down-time, as well as allowing more efficient man-hour usage.

This project resulted in a tangible annual cost savings of \$7,023.

Contact for more information:

George B. Nelson (Sverdrup Technology Inc.)  
601-688-1336

103. INSTALLATION OF MOLSIEVE 5A CAPILLARY COLUMN IN VARIAN GAS CHROMATOGRAPHS

*Stennis Space Center (SSC)*

Description of the Activity:

The varian gas chromatographs in the Gas Analysis Laboratory at Stennis Space Center (SSC) were equipped with Molsieve 5A packed columns through which the sample gas flowed. These packed columns were replaced with Wide-Bore 5a capillary columns which permitted decreased analysis time along with higher sensitivity.

Benefits Achieved:

Analysis time was reduced by a factor of nearly 12, and test sensitivity was greatly improved.

The annual tangible savings from this project is \$9,630.

Contact for more information:

George B. Nelson (Sverdrup Technology Inc.)  
601-688-1336

104. RE-USABLE MAGNETIC PARTICLE POUCH

*Stennis Space Center (SSC)*

Description of the Activity:

The Non-Destructive Testing Laboratory was using dry powder for magnetic particle inspection. The method required considerable clean-up after the test to remove the powder from the surface being tested.

The new method utilizes a re-usable plastic pouch containing highly sensitive magnetic particles in a thin, colorless liquid.

Benefits Achieved:

This process provides the following benefits:

- higher contrast/sensitivity that improves quality;
- applicable under water;
- no clean up required;
- substantial reduction in pretest preparation; and
- savings in testing materials.

Annual cost savings are estimated to be \$11,847.

Contact for more information:

George B. Nelson (Sverdrup Technology Inc.)  
601-688-1336

#### 105. SEMI-ANNUAL CALIBRATIONS OF MOISTURE ANALYZERS

*Stennis Space Center (SSC)*

Description of the Activity:

The Gas and Materials Laboratory has moisture analyzers which require semi-annual calibrations by the Standards and Calibrations Laboratory. A moisture analyzer which contains an internal calibration system traceable to the National Bureau of Standards (NBS) was procured. This analyzer, which contains and NBS-traceable moisture generator, will serve as the laboratory standard for moisture determination.

Benefits Achieved:

By using existing computer programs to plot calibration curves, the other analyzers can be calibrated in the Gas and Material Analysis Laboratory. This project improved the quality of the calibration and resulted in an annual cost savings of \$5,280.

Contact for more information:

George B. Nelson (Sverdrup Technology Inc.)  
601-688-1336

## 106. SIGNIFICANT MODIFICATION ON THE FLUID COMPONENT PROCESSING FACILITY

### *Stennis Space Center (SSC)*

#### Description of the Activity:

The Fluid Component Processing Facility (FCPF) at the Stennis Space Center has undergone significant modifications and improvements to enhance quality, productivity, and timeliness of processing components necessary for testing the Space Shuttle Main Engine (SSME). The FCPF services, repairs, assembles, and tests mechanical components related to test support equipment and supporting industrial systems.

Included in this support function are the high pressure gas and cryogenic barge systems. The FCPF process was selected by SSC as the center's candidate for productivity improvement and the initial implementation of TQM principles. Management in the shop is fully committed to continuous improvement. One active employee team has been meeting successfully since 1984 and has recently begun analyzing the component processing system to reduce and eventually eliminate rework.

#### Benefits Achieved:

Several facility improvements are nearly complete in the shop. Among them, the installation of a new de-ionized water system employing state-of-the-art charged membrane technology. The system is equipped with electronic controls and monitor devices that will reduce manpower by nearly 750 hours per year.

A new freon recovery system was installed this year in the FCPF. This initiative will double the FCPF's capacity to recycle freon. The automated features of this system will reduce labor effort by 1,000 man hours per year. Additional savings will be realized in utilizing less costly freon. A conservative estimate of these additional cost savings are \$7,200 per year.

Significant benefits are also anticipated to the local environment from the ability to recycle freon rather than dispose of it externally. Finally, a new clean line, the enlargement of level 10,000 clean room, and the improved flow of work through the shop will allow this operation to reduce overall cost-to-process components by an expected 7.5 percent in FY90.

Contact for more information:

Marco Giardino  
601-688-2739

## 107. USE OF QUARTZ DIFFUSION CELL TO PURIFY SITE-GRADE HELIUM

*Stennis Space Center (SSC)*

### Description of the Activity:

In the Gas and Material Analysis Laboratory (G&MAL) at Stennis Space Center, it is necessary to use pure helium as the carrier gas in the helium gas chromatograph (GC). In addition to the 6-8 weeks cylinder delivery time and the 2-6 hour destabilization period in the GC each time the helium cylinders are changed, helium of this purity is quite expensive.

These problems were alleviated by using a quartz diffusion cell to purify site-grade helium; a much less expensive grade of helium which is piped into the laboratory. The purified helium is then sent to the GC.

### Benefits Achieved:

This project achieved a tangible annual cost saving of \$22,560.

In addition, intangible benefits result from the elimination of helium cylinder delivery time and paperwork, and GC destabilization down-time when the helium cylinder is changed.

Contact for more information:

George B. Nelson (Sverdrup Technology Inc.)  
601-688-1336

## 108. UTILIZATION OF PUBLIC DOMAIN SOFTWARE

*NASA Headquarters (Code TX)*

### Description of the Activity:

The Office of Space Operations (OSO) and its systems support contractor, MITRE Corporation, have reviewed existing software tools available from industry for application in OSO decision making in major programs, especially the Advanced Tracking and Data Relay Satellite System (ATDRSS). A number of little known sophisticated analysis and simulation tools developed with public funds by COMSAT Corporation have been identified. These are available at nominal cost of \$2,000 each, a small fraction of the \$100,000 or more each would cost to develop.

### Benefits Achieved:

We are presently acquiring an antenna coverage program, a channel modeling program, a satellite transmission program, and are evaluating several others. We expect these tools to improve our technical and cost analysis capability in critical areas, thereby permitting well informed and efficient program decisions.

Contact for more information:

Daniel Brandel  
202-453-2030

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**109. ELECTRONIC TRANSFER OF SURVEY DATA**

*James R. Dubay (left), President and General Manager of EG&G Florida, Inc., (participating in EG&G's "Trading Places" program), assisted by Jim Sherrill (center) and Donnie Lanthorn (right), gains a better understanding of the benefits of electronically transferring data.*



## V. QUALITY ASSURANCE

### 109. ELECTRONIC TRANSFER OF SURVEY DATA

*Kennedy Space Center (KSC)*

#### Description of the Activity:

EG&G Florida's Survey Team was requested to develop a process for electronically transferring survey data to a computer work station in order to generate design files to be used by EG&G Civil/Structural Design. This process was successfully developed by using an electronic theodolite software which provided the means for transferring data from the field survey recorder to a computer work station. A special FORTRAN program was then written to process and download the data to a CAD file. The computer operator then created a site plan design file for use by EG&G Civil/Structural Design.

#### Benefits Achieved:

Three major benefits have been demonstrated by implementing the above process: (1) survey field time has been reduced more than 50 percent by eliminating the handwritten field notes; (2) interpretation of field survey notes and manual drafting to create a drawing has been eliminated; and (3) quality of data has been significantly improved by the automatic transfer of field survey data. Complete survey data is now readily available to users in the form of a completed design file. Data collected for specific engineering projects have been used to update the locations of buildings and other structures on maps maintained by EG&G Master Planning. Topographic data has been used by EG&G Environmental Management for monitoring groundwater elevation and storm drain runoff.

Contact for more information:

Joe Kaplet  
407-867-7097

### 110. NESSUS SYSTEM EVALUATES RELIABILITY AND RISK

*Lewis Research Center (LeRC)*

#### Description of the Activity:

The NESSUS System is a computational structural analysis technology which provides a comprehensive capability for quantifying the uncertainty of propulsion structure performance, reliability, and safety. NESSUS was developed over a five-year span by Southwest Research Institute under contract to and in consultation with the Lewis Structures Division, and represents a vastly improved facility for propulsion structural risk analysis and assessment.

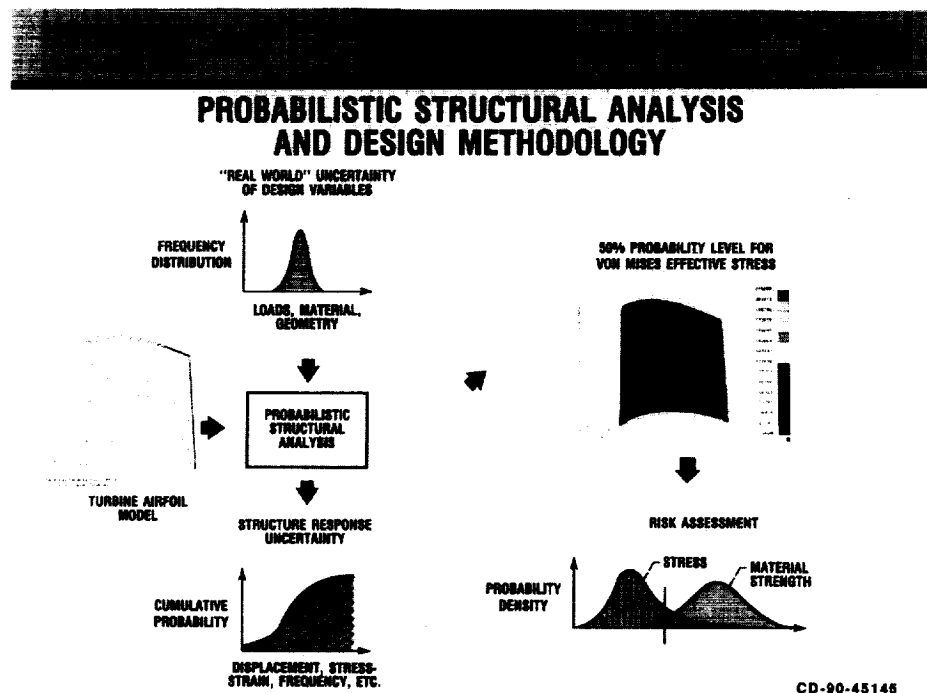
A User Workshop was hosted by the center to introduce the government, industry, and academic propulsion communities to the new technology, providing them with an orientation to the NESSUS methodology of probabilistic analysis requirements.

#### Benefits Achieved:

The NESSUS System will allow users to do a better and more comprehensive job of evaluating durability, reliability, and risk of space propulsion structures. It provides for computational simulation of structures from single components to assemblies. This is especially critical in today's environment where contractors are being asked up-front to demonstrate superior methodologies for risk assessment on high technology projects. Although designed for propulsion structures evaluation, NESSUS has potential for application to a wide variety of structural systems requirements.

Contact for more information:

Dale Hopkins  
216-433-3260



*The NESSUS System allows users to do a more comprehensive job of evaluating durability, reliability, and risk of space propulsion structures.*

## 111. CLEANING GENERAL USE GLASSWARE

*Stennis Space Center (SSC)*

### Description of the Activity:

The method of cleaning general use glassware in the gas and materials laboratory included washing in detergent, rinsing with distilled or de-ionized water and with isopropyl alcohol. A final cleaning with freon and collecting a sample from the surface area to test for particles completed the process. The final cleaning with freon and the particulate test was determined to be unnecessary for general use glassware.

### Benefits Achieved:

Elimination of the final cleaning and test resulted in annual cost savings of \$30,240. Additional benefits will be realized from not using freon which is detrimental to the ozone layer.

Contact for more information:

George B. Nelson (Sverdrup Technology Inc.)  
601-688-1336

## 112. GASEOUS NITROGEN (GN2) TANK REPLACEMENT ON HYDROGEN BARGES AT SSC

*Stennis Space Center (SSC)*

### Description of the Activity:

At Stennis Space Center (SSC), the barges used to transport the liquid hydrogen necessary for supporting the SSME testing at the site undergo an annual recertification inspection and analysis to assure their structural integrity, safety, etc. As a result of changes in the safety specifications, the gaseous nitrogen (GN2) tanks, used for hydrogen valve actuation and system purging on two of the three hydrogen barges, did not pass these inspections. A recommendation from an engineer, who was not assigned to the recertification project, resulted in the following action: thicker-walled GN2 tanks that were no longer in use on lox barges were installed to replace the defective tanks.

### Benefits Achieved:

A conservative estimate of tangible benefits realized from using the replacement GN2 tank is \$25,000 for each of the two hydrogen barges, or a total cost avoidance of \$50,000.

In addition, several intangible benefits were derived from this project:

- Identical hardware configuration was instituted for all three operating barges.

- Timely support of SSME testing was achieved, with no down-time due to barges being unavailable.
- Time and costs associated with changing interfacing systems, documentation, and operating and maintenance procedures were also avoided.

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601-688-1336

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Joyce R. Jarrett  
Director, NASA Quality and Productivity  
Improvement Programs

